THE

ELECTRICAL REVIEW.

VOL. LXVI. MAY 13, 1910. No. 1,694.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: May 13, 1910. [No. 1,694.

	Page
This Realm—This England	765
Long Live the King	766
The New Anglo-French Telephone Cable	766
Germany's Trade in South Africa	766
A Japanese Professor's Prejudice	766
Westminster Street Lighting	767
The Electric Furnace in the Steel and Iron Industry	767
Rubber Production and Prices (*illus.*)	768
Copper Production and Price in 1909: The Present Outlook (*illus.*)	769
Correspondence:—	
Inspection of Coal Mines	770
Japanese Government ignores British Electrical Manufacturers	770
Electricity in Mines	771
India-rubber Gloves for Extra-High-Pressure	771
Electrically-driven Ring-Spinning Frames	771
Committee for Protection of Electrical Interests	772
Legal	772
Business Notes	774
Notes	782
Electric Power at Messrs. Cammell, Laird & Co.'s Tranmere Works (*illus.*)	783
Apparatus for Works Equipment (*illus.*)	786
City Notes	788
Stocks and Shares	798
Market Quotations	798
Share List of Electrical Companies	799
Proceedings of Institutions:—	
The Physical Properties of Switch and Transformer Oils (*concluded*)	801
A Telephone Relay (*illus.*)	803
New Electrical Devices, Fittings and Plant (*illus.*)	806
Foreign and Colonial Tariffs on Electrical Goods	807
Expiring Patents	807
New Patents Applied For, 1910	808
Published Specifications	808
Contractors' Column	Advertisement pages xxiv and xxvi

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 25, Murray Street. TORONTO, ONT: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOUVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION

H. ALABASTER, GATEHOUSE & CO.,

4 Ludgate Hill, London, E C

THIS REALM—THIS ENGLAND.

DURING the past week, in the heavy sorrow that has overtaken the Empire, many obscuring distinctions that are in ordinary circumstances thought to be permanent, have broken down; and in the darkness of the shadow of death the principle of reverence for what is noblest has assumed its proper proportions. Those of us whose lives are for the most part absorbed in some special branch of commerce in things material, have learned this week of the narrowness of our vision; but in the common grief at the demise of King Edward, in that wonderful mourning that bears witness around us, and that extends to the countless millions of subjects in the British dominions beyond the seas, can be discovered something of the value of a life devoted as was his to securing the continued welfare of all ranks and classes of his people. It is well to think of him as the Peacemaker, for so, indeed, he was, but it is also well to realise that his methods of securing peace were based not merely upon sentiment, but upon fighting strength. He placed his name at the head of the Navy List, and he became the main support of those who built up our Fleet as it is. His reign was associated with an important chapter in engineering science, for it covered the period when the turbine was established as a trustworthy means of propulsion for sea-going ships of war, when electrical methods for actuating heavy machinery became better understood, and when wireless telegraphy emerged from the laboratory into the realm of commercial systems of word transmission. The long controversy regarding the water-tube boiler had ceased, and our supremacy at sea was within the possibility of being threatened. In addition there was proceeding from a certain section of the public a demand for the reduction of expenditure upon armaments. It was in these circumstances that the Dreadnought came into existence, and it is to King Edward's personal support of the Dreadnought policy, and to his upholding of the establishment of the Home Fleet, that we owe our present naval supremacy. His firmness was ever tempered by benevolence, and it was directed by a wonderful measure of common sense towards the maintenance of the strength of the Empire and thus towards the peace of the world.

King Edward was quick to discern the merits of an advance in practical engineering, and he extended considerable favour to those who were endeavouring to perfect wireless telegraphy and the motor vehicle. It would appear, however, that natural philosophy attracted him only in so far as it conferred benefits upon mankind. In this respect he was, perhaps, less appreciative than was his father, of science for its own sake. The explanation is, no doubt, to be found in the fact that he was educated towards ends other than those dreamed of in our philosophy. To him humanity was an open book, and reading therein he saw life steadily, and he saw it whole. Human suffering called out his most strenuous efforts; he became the central support of surgical and medical science, and the guardian of every charity that seemed worthy of help. At a critical time in our history he has gone to his long rest, honoured, and loved and mourned, and teaching us to work together as men to uphold, and not to mar, the heritage of this Empire—this greater England.

Long Live the King!

The continuity of our monarchy is transmitted in a manner at once dignified and peaceful, and with the least possible disturbance of public affairs, to King George V. His claims upon our regard are manifold, for he has already displayed a considerable amount of zeal in stimulating this country to direct its efforts towards securing a firmer foothold in the markets of the world. His association with the Navy, and his intimate knowledge of the Colonies, form a promising foundation for a monarch who will be called upon to grapple with questions of cardinal importance affecting the defence and policy of the distributed units of his Dominions. Those who travelled with him during those expeditions had an extended opportunity of judging of his high qualities, and they testify to his steady purpose, and we are convinced that a King more full of promise never inherited the British Throne. He has revealed his belief in the advantages of an engineering training by sending his two sons to Osborne and to Dartmouth to follow the course for cadets at the Royal Naval Colleges. In the workshops of those excellent institutions, attired in boiler suits, the young Princes are going through the routine with the same zeal that their illustrious father exhibited in the Service, and the engineering profession may well be proud of its Royal Students.

The New Anglo-French Telephone Cable.

As is invariably the case when some scientific advance in practical engineering is announced, the daily Press, ever on the alert for copy, treats the general public to a wonderful *mélange* of fact and fiction, and writes glibly about the "revolution" which the new invention is going to bring about. It is to be feared that in many cases the statements that are made are due not entirely to the imaginations of the writers, but partly to incorrect information being given by those who are not in a position to furnish actual facts. The case of the new Anglo-French Telephone Cable—which has just been laid, but not yet brought into use—is an example of the misstatement of facts which so often occurs. This cable is undoubtedly a very distinct departure from ordinary practice in submarine cables and marks a new epoch in submarine telephony. The possibility of introducing "Pupin" or "loading" coils (as they are termed) in submarine cables has been mooted for some time past, but it has remained for Messrs. Siemens Bros., through their engineer, Mr. Dieselhorst, to carry out practically the work of constructing a cable (with four cores, forming two telephonic circuits) in which such coils are included, and this has been done with every prospect of a permanent success.

Speaking generally, the introduction of the Pupin coils—at a distance apart of 1 knot, and embedded in the cores in a manner devised by Mr. Dieselhorst—has improved the speaking value of the cable over 300 per cent.; *i.e.*, the same telephonic volume of sound and clearness of articulation can be obtained through the 21 knots of cable (its actual length), as would be obtained through rather less than 7 knots of a similar type of cable (as regards the weights of the conductor and dielectric), in which loading coils are not included. This is a most satisfactory result, but it is quite incorrect to say that the use of this cable will increase the speaking distance between England and France anything like 300 per cent., and this for the simple reason that the cable is but a small portion of the total length of line through which commercial telephonic speech takes place and is possible. As a matter of fact, the total distance through which telephonic communication with the original unloaded cables is carried on is much greater than that simply between London and Paris. Manchester can, and does, speak through to Paris, also Nottingham can speak through to Lyons, Ipswich to Bordeaux, and so on. The actual improvement which will result on the total length of line spoken through, if the loaded cable is substituted for the unloaded cable, will probably be on the average somewhere in the neighbourhood of 25 per cent., the exact amount of improvement depending upon the nature of the trunk lines. To put it in another way, it is probable, we understand, that with the loaded cable it will be possible to increase the ordinary speaking distance when a heavy trunk line (800 lb. copper per mile) is being used, by about 150 miles, or with a light trunk line, about 70 miles.

The value of the new loaded cable is not, however, to be measured only by the improvement which it will effect in telephonic communication between England and France. If the cable proves to be a permanent success (of which there is little doubt) it will in all likelihood be the precursor of other and longer cables, which, if unloaded, would be almost useless telephonically; in this respect the cable may be looked upon as an experimental one, and not, as has been stated, one installed simply for the purpose of improving communication between England and France.

The introduction of loading coils into a cable does not, it may be stated, effect any improvement in "telegraphic" transmission; this has been proved by actual experiment.

Germany's Trade in South Africa.

Attention may very well be directed to the steady growth of the electrical trade which is being conducted by the German manufacturers with South Africa. During the month of February electrical machinery had increased from 211 to 251 tons over the corresponding month of last year, and under various sections dealing specifically with electrical matters there is a very notable increase. The *British and South African Export Gazette*, in addition to publishing the foregoing statistics, comments on the great developments in electric operations on the Rand Mines, but points out that the demand thus created for electrical machinery will bring little good to the British manufacturer by reason of the participation of Germany in the financing of the large power schemes of South Africa. While we deplore equally with our contemporary the loss to British electrical firms of so important a market, it is difficult to see what more could have been done by British interests to secure the position. Probably there may have been some lack of co-operation between the manufacturing and financial interests; but we would ask whether it was ever intended that orders for plant should be placed in England. In one quarter we are told that the English financiers were too slow to realise the advantages of the Rand power scheme, in another that the British manufacturer could not make the machinery. It was stated by one London financial editor that as the British public failed to find the £900,000 required by the Victoria Falls Co., the Germans willingly agreed to provide the amount, but on the express condition that the necessary plant, costing nearly a million sterling, should be obtained from German manufacturers.

A Japanese Professor's Prejudice.

Every week some new proof reaches us of the imperative necessity for British electrical manufacturers to be up and doing in the protection of their legitimate interests abroad. There are clouds of prejudice in the minds of some men of authority in foreign nations, and there are gaping voids of ignorance concerning our electrical manufacturing ability. It may fill us with surprise that it should be possible for the prejudices of one man to cut off, as it were with a stroke of the pen, the names of all British firms when asking foreigners to

quote; and our own feeling is the more justifiable in view of the efforts that we have made to cultivate a closer friendship and larger trade relationship with the country which, when it wants electrical goods, gives us the cold shoulder and invites our rivals, purely because the man in authority thinks we are of no account. We refer our readers to the letter appearing in our "Correspondence" pages to-day from "British Importers." If there is any class of machinery the British electrical manufacturer knows how to design and make economically and efficiently it is electric motors and generators, and Government and other public departments in Japan have experienced that for years, and have expressed their complete satisfaction. We have, of course, known of the hold of United States electrical firms upon Japan, but this story of prejudice in high places comes to us as a quite astonishing piece of information—we cannot understand it; we can only ascribe it to pure prejudice against us or partiality for American, Continental or home-made goods, and to power being given to a man who cannot have had the requisite experience to enable him to exercise it fairly. We hope the matter will be thoroughly inquired into by Japanese authorities in this country with a view to ensuring a fairer treatment for us henceforth.

The incident, as we have said, strikingly shows that we have somehow got to clear away the misunderstandings that exist among some men in various countries regarding the electrical manufacturing abilities of the United Kingdom, and we have got to aggressively keep these abilities to the fore. We have endeavoured to do something in this direction ourselves during the past year, by making British electrical firms and their wares better known; but there is room for further effort, which calls for the fullest possible co-operation between the ELECTRICAL REVIEW and the trade.

Westminster Street Lighting.

OUR contemporary the *Electrical Times* unkindly accuses us of extinguishing the last chance of the St. James' and Pall Mall Co. of retaining their present share of the public lighting in Westminster, our note of April 22nd having been quoted at the meeting of the City Council by the Chairman of the Works Committee, Mr. Jacques Abady, in support of the decision of the Council to accept the gas company's tender. In its eagerness to make a display of zeal on behalf of the electrical company, our critic rushes into error, for the matter had already been definitely settled at the previous meeting of the Council, which formed the subject of our note, and could not be reopened, the order having been passed to the gas company for the whole of the work, in accordance with the Council's resolution. The report upon which the question was raised related purely to the details of the gas lighting, not to the acceptance of tenders.

It was alleged by Councillor Abady that the company could have tendered for the supply of these arc lamps alone, in the first instance; this, however, was not the case. Such a tender would have failed to comply with the conditions of contract, as we made clear in our last issue. It is true that the Council had the power to subdivide a district, but the contractor had not this power; and a proposal to refer back the question of the arc lamps in the Pall Mall district for further consideration had been deliberately rejected at the previous meeting.

The belated proposal of the St. James' Co. to continue the arc lighting at a price lower than that of the gas company was so obviously out of order that it could not possibly have been accepted. To accept a fresh tender after the competing prices had been published would be contrary to the most elementary rule of public contracts—a fact ignored by our contemporary.

The Electric Furnace in the Steel and Iron Industry.

THE electric furnace has now been in practical operation and under observation for some 10 years, but still its true position is far from being settled. In a recent review of the subject, the *E.T.Z.* points out that in Sweden, with a plentiful supply of cheap water power and fuel at a high price, the direct production of pig-iron from the crude ore has been proved to be practicable and economical. Where the relative costs of power and fuel are such as to make the complete electrical process unprofitable, it is still possible and advantageous to employ the electric furnace for portions of the process. On this account the energy consumption per ton of steel is a very variable quantity, depending on just what fraction of the work has been done electrically, as well as on the size of furnace employed. The consumption, in fact, varies from a maximum of some 3,000 KW.-hours per ton of steel for the complete electric process (starting with the crude ore and passing through pig-iron to pure steel) down to a minimum of some 50 KW.-hours per ton, where the energy is merely used to keep the finished steel or iron at the pouring temperature.

The whole question, moreover, is not entirely an economical one, but also one of quality of product, for the electric furnace, whether used alone or as an adjunct to existing plant, may be considered either as a means of producing material of the same quality as hitherto, at a lower cost, or as a means of producing improved material (commanding a better price on account of increased strength, &c.) at a slightly increased cost. Or, again, owing to the greater freedom from impurities and the higher temperature available, the electric furnace may justify its use by enabling low-grade native ores to be employed in place of higher-grade imported ones.

If, for the sake of a very rough comparison, the costs of ore, fluxes, interest on loans and amortisation are assumed equal for the ordinary thermal process and for the electric furnace process of producing pig-iron, the relative costs of production will depend on the cost of energy and the cost of reducing carbon. Assuming the usual allowance in the ordinary process of 1 ton of coke per ton of pig-iron produced, and taking the average cost of coke in Germany, the cost of fuel per ton of iron will be 15s. In the electric process, experiments in Sweden show that only about ·3 ton of coke is required per ton of pig-iron produced, and the cost of coke per ton of iron is, therefore, 4s. 6d., leaving 10s. 6d. over for the cost of electrical energy. The Swedish experiments also show that something like 2,000 KW.-hours, on the average, is required per ton of pig-iron produced electrically from the ore, and this figure is too near the theoretically necessary value to give hopes of any marked reduction. Unless, therefore, the cost of energy is below about ·06d. per KW.-hour, the electric process will prove the more costly. In countries where fuel is cheap, the complete electric process is, therefore, practically out of the question; but it may prove useful where fuel is expensive or cheap water-power is available.

Turning next to the production of special or crucible steels, the electric furnace offers the advantages of producing material of quality at least equal to that of the older process, and of permitting much greater weight of material to be dealt with at one time, thus economising in the cost of crucibles. For these reasons most of the well-known steel makers have installed electric refining furnaces either in place of, or in combination with, crucible furnaces. If, for instance, whilst continuing the production of Siemens-Martin steel, Bessemer steel or Thomas steel, these materials, in the fluid state, are transferred to an electric furnace, they can there, at comparatively small cost, be converted to steel of improved quality up to the equivalent of the best crucible steel. This refining process may take anything from 100 to 300 KW.-hours per ton, but the cost of this energy no longer bears so important a relation to the selling price of the improved material. It need not cost more than from 12s. to 30s. per ton, even when produced in steam or gas-driven supply stations.

It is in this direction, at least in Germany, that the use of the electric furnace is expected to advance, but increased experience is still necessary and it will probably not be much longer delayed, because the introduction of an electric furnace involves no very great outlay or wholesale replacement of existing plant.

D

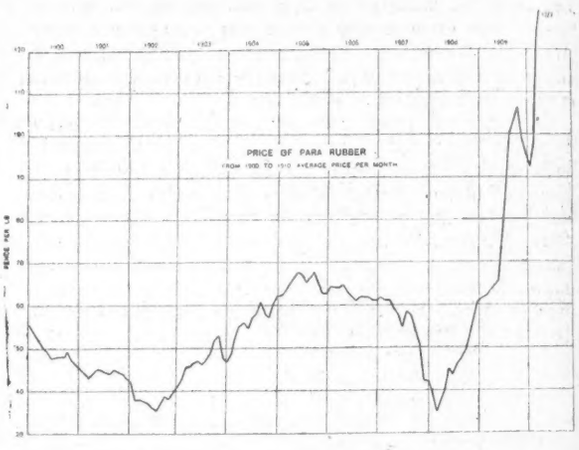
RUBBER PRODUCTION AND PRICES.

The condition of any market depending upon a crop is liable to sudden and severe changes, especially when, as in the case of rubber, the product takes a considerable time to reach maturity. It then becomes practically impossible to meet a sudden demand, and a rapid growth in consumption results in a struggle for what is actually on the market. In addition to cultivated rubber, and, at present, far distancing it in quantity of production, there is the wild rubber, and this state of things has a tendency to encourage the speculative element, on account of the difficulty of estimating what may be expected from exploration, or from concessions recently opened up. There can, however, be little doubt that at the present time the price is largely inflated by speculation. A glance at the accompanying curve shows that, at the present rate of increase, the price attained will shortly be prohibitive for commercial purposes. The world's production for 1910 has been estimated at 80,000 tons, but even this can have little effect on a solid demand, which has obviously been finding a shortage since the end of 1908. Brazil is, of course, far and away the largest producer of rubber, and owes its position to the fact that the principal rubber-bearing tree (Hevea Braziliensis) is indigenous to the country, and has increased by natural, as opposed to cultivated means. The native labourer, being naturally opposed to continuous exertion, is content with less than half the year's work on the process of tapping and collection, and thus the trees have not been exhausted, and the selection of full-grown trees for tapping is the rule. Whether the superiority of Para rubber be due to the climate or to long experience in curing, it remains a fact that fine hard cured rubber of this designation is the leading quality in commerce, and, until quite recently, it had no rival in the matter of quantity, in the plantation-raised rubber from other countries. Even at the present time the large proportion of the world's supply comes from what is called "wild" rubber.

Central Africa comes second in importance as a natural producer. Recent statistics have, however, shown a falling off in the quantity of African rubber owing to wasteful methods of collection. The present "boom" has drawn attention to the plantations of the Malay Peninsula, Ceylon, Sumatra, Java and India. Taking 134 companies quoted in one of the trade papers, it was found that 71 concerned properties situated in the Malay States or elsewhere on the Peninsula, 14 are in Ceylon, 12 in Sumatra, 6 in Java, 10 in Borneo, and only 2 in Brazil and 3 in Africa. Of 98 companies issued since January 18th, 1910, 25 are in the Malay Peninsula, 22 in Java and Sumatra, 13 in India and Ceylon, 5 in Brazil, 2 in Bolivia, 1 in Peru, and 11 in Africa. Seeing that Brazil is known to be the richest producing country, it would appear that properties there are not easily acquired, and that, therefore, increased production is to be derived from cultivated trees in Malaysia. It is evident from this that a maintenance of the present brisk demand is anticipated, and although one can hardly expect such a price as 12s. to 13s. a pound to be maintained, there appears ample justification for the anticipation that rubber will remain at something over 6s. for a considerable time. An advance on present prices would soon begin to have disastrous effects on the important industries which make use of the commodity, such as electrical cable makers and manufacturers of rubber tires. The minor trades will probably be able to find some mixture or substitute which will serve their purpose. This refers to such uses as rubber mats, and possibly goloshes, which are an extensive business in the States.

If the extensive planting at present projected is carried out, the supply should increase extensively in the course of a few years; but as the Hevea, the most valuable producer, takes from five to seven years to come to maturity, the influence in this direction can only be slow. It is curious that the attention of the market should be at present concentrated on the Malay district, as one would have thought that the immediate supply could only be increased by recourse to existing "wild" growths, to be opened up by further exploration or by purchase of concessions from the countries interested. Of course, security of title enters largely into this consideration.

Up to the present time the supply has developed slowly. For the year ending June, 1900, the world's supply was 48,352 tons. At the end of June, 1905, the return was 65,083 tons. In the following year it fell to 62,574 tons. It will be noticed that the first period of increased prices reaches its peak in 1905, and it may be argued from this that here supply caught up with demand. For 1909 the rubber production of the world is estimated at about 70,000 tons, and for the present year it is expected to be in the neighbourhood of 80,000. It will be noticed that while the increase from 1900 to 1905 was 16,731 tons, the increase from 1905 to 1910 is not estimated to be any more, in spite of the stimulating effect of this year's prices. Although hampered by the fact before alluded to, that from five to seven years must be allowed for the new crop to come to maturity, it is evident that considerable effort was made at the commencement of the expansion in demand to increase the supply, and by 1905 there was ample evidence to show



that this demand could only go on increasing. From this one would have expected extensive fresh planting, and a crop just coming due, but, unfortunately, this appears to be one of the industries in which the cultivator is inclined to overwork his trees in the time of high prices, and to pay too little attention to future growth, with a consequent squeeze, such as we are at present experiencing. The production of rubber appears to be peculiar to mild, swampy climates, and the relation of the quantities supplied by the various districts does not appear to vary extensively. In 1907 tropical America (Mexico, Brazil, Venezuela, Bolivia, Peru and Central America) contributed 60 per cent. of the total production, and this proportion was practically the same last year. Tropical Africa came next with 30 per cent., leaving only 10 per cent. for Malaysia, Borneo, Ceylon, &c. Under the encouragement of the present prices, it is more than likely that the Brazilian production for this year will be considerably in advance of the estimate. Expansion in other districts is, generally speaking, slow, and rather intermittent. The production of the Malay States for the five years preceding 1908 was as follows:—

	1904.	1905.	1906.	1907.	1908.
Tons ...	960	975	1,177	1,714	1,562

For 1909 the production for Malaysia is estimated at 3,300 tons.

The growth of production in Ceylon is more rapid:—

	1904.	1905.	1906.	1907.	1908.	1909.
Tons ...	33	60	149	255	419	700

Compared with these, the Brazilian production is considerable:—

	1904.	1905.	1906.	1907.	1908.	1909.
Tons ...	28,200	31,217	31,364	34,835	37,598	38,000

The production of West African rubber is falling off. In 1906 the production was 17,200 tons; in 1907, 17,000; in 1908, 14,000, and only a small increase was shown last year. This is attributed to the practice of cutting down the vine to secure the rubber. There has existed for some years a law in British, German and French coast colonies in Africa enforcing the replacement of any rubber vines

destroyed. As to the time taken by this species (Landolphia) to reach maturity, experts vary, some giving as much as 30 years. The danger of a situation such as the present is the temptation to tap immature trees, the rubber so obtained being regarded as far less durable than rubber from the mature tree. Indeed, rubber from young trees has been characterised as "commercially useless," and the process must, in the end, about halve the yield which the tree should give. If this were to obtain extensively, and the market be flooded with unsatisfactory rubber, resulting in a set-back which would re-act on planting, the ultimate dearth of trees would result in a rubber famine indeed.

COPPER PRODUCTION AND PRICE IN 1909 THE PRESENT OUTLOOK.

By JOHN B. C. KERSHAW.

The large amount of copper used by electrical engineering firms, and the rumours that have lately been circulated on both sides of the Atlantic concerning a reduction in output and rise in price during the present year, render the study of last year's figures for the price and production of copper of considerable interest and importance to readers of the Electrical Review.

I. *Production in 1909.*—The output of raw copper in 1909, according to the figures compiled by Messrs. H. R. Merton & Co., of London, and published by them in their annual statistical circular, was 839,255 tons—an increase of 84,945 tons over the previous year's total of 754,310 tons. This increase of 84,945 tons is the largest tonnage increase yet recorded in the annals of the copper-mining industry, and represents 11·2 per cent. on the previous year's output. The following table shows the aggregate output of all copper-mining countries for the past 10 years, with the percentage annual increase :—

Year.	Aggregate production in long tons.	Increase or decrease.	Percentage increase or decrease.
1900 ...	479,514	+ 7,270	+ 1·5
1901 ...	516,628	+ 37,114	+ 7·7
1902 ...	541,295	+ 24,667	+ 4·7
1903 ...	574,775	+ 33,480	+ 6·1
1904 ...	644,000	+ 69,225	+ 12·0
1905 ...	682,125	+ 38,125	+ 5·9
1906 ...	714,100	+ 31,975	+ 4·6
1907 ...	713,865	— 235	— ·03
1908 ...	754,310	+ 40,445	+ 5·7
1909 ...	839,255	+ 84,945	+ 11·2

The copper production of the world has, in fact, doubled during the past 12 years, for in 1897 the aggregate output of all countries only amounted to 399,730 tons. The enormous increase of the past year is chiefly due to the larger output of the mines in America, Africa and Mexico, the following tabular statement showing the relative gains and losses of the leading copper-mining countries :—

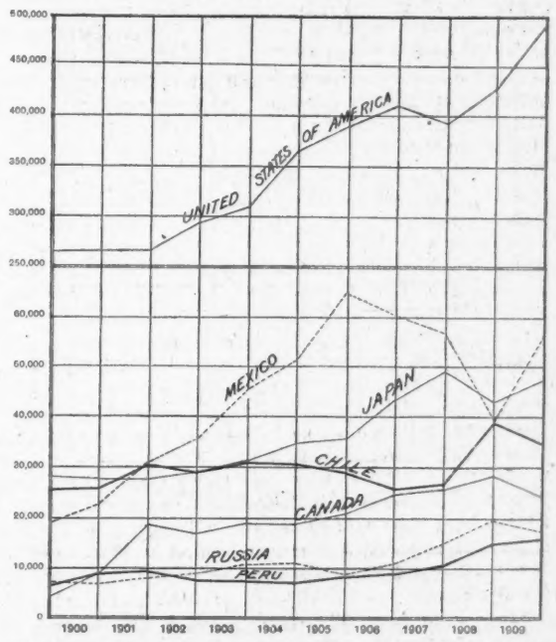
	1908. Tons.	1909. Tons.	Gain. Tons.	Loss. Tons.
U.S.A.	423,300	490,310	67,010	—
Mexico	39,990	56,240	16,250	—
Spain and Portugal ...	52,585	52,185	—	400
Japan	43,000	47,000	4,000	—
Chile	38,315	35,785	—	2,530
Australasia	39,500	34,400	—	5,100
Canada	28,570	24,105	—	4,465
Germany	20,200	22,455	2,255	—
Russia	20,085	17,750	—	2,335
Peru	15,000	16,000	1,000	—
Africa	6,880	14,945	8,065	—
Norway...	9,190	9,080	—	110
Hungary	2,240	4,505	2,265	—
Remaining countries ...	15,435	14,495	—	960
Totals	754,310	839,255	100,845	15,900

Net gain = 84,945 tons.

The most notable increases in the above table have already been referred to, and it is of interest to analyse the production returns of the U.S.A., Africa and Mexico still more closely, in order to see exactly which groups of mines have been responsible for the large increases over the 1908 output. The following figures are given in Messrs. H. R. Merton & Co.'s last circular :—

U.S.A. Mines.	1908. Tons.	1909. Tons.	Increase. Tons.
Calumet and Hecla ...	40,000	40,000	—
Mother Lake mines ...	59,225	61,350	2,125
Montana	112,750	140,665	27,915
Arizona...	129,540	129,945	405
Other States	81,785	118,350	36,565
		Total ...	67,010
Mexican Mines.	1908.	1909.	
Boleo	12,400	12,230	— 170
Other Mexican mines	27,590	44,010	+ 16,420
	Total net increase ...		16,250
African Mines.	1908.	1909.	
Cape company... ...	4,480	4,645	+ 165
Namaqua	2,400	2,300	— 100
Sundries	—	8,000	+ 8,000
		Net gain ...	8,065

These figures show that it is the outside mines of the U.S.A. and of Africa and Mexico that have been chiefly responsible for the increased production of 1909, these three groups of mines having a net gain of 60,880 tons to their credit, out of the total net gain of 84,945 tons.



Each vertical division represents, in the lower part of the diagram, 10,000 tons; in the upper part, 50,000 tons. Each lateral division represents one year.

Fig. 1.—Copper Outputs of the more important Mining Countries for the past Ten Years.

The most notable decreases in the production of 1909 have been those of the Canadian and Australasian Mines.

In the case of the latter, the prolonged trouble in the coal-mining industry has been chiefly responsible for the diminished output of the copper mines.

The relative positions of the more important copper-mining countries as regards output of copper for the period 1900-1909 are shown in diagrammatic form in Diagram I. The comparatively steady progress of the United States mines and the fluctuations in the output of the mines of Mexico and Chile are brought out clearly in the diagram. The figures for Germany and for Spain and Portugal are not included, since their annual production of copper is maintained fairly steady at 20,000 and 50,000 tons respectively, and the fluctuations above or below these totals are small.

II. *Price Variations.*—At the close of an article on "Copper" published in the *Electrical Review* (Chicago) of May 1st, 1909, the writer stated his belief that copper would descend to a lower level of price before any recovery occurred. The record of the price of copper during 1909 shows that this forecast has been correct.

The settlement prices of standard copper at the close of each month of the past year are given as follows by Messrs.

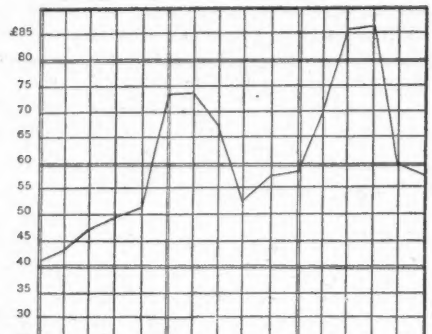
H. R. Merton & Co. in their valuable statistical circular for March 31st, 1910 :—

	£	s.	d.		£	s.	d.
December 31st, 1908...	63	15	0	June 30th ...	58	17	6
January 30th, 1909 ...	58	10	0	July 31st ...	58	7	6
February 27th ...	56	2	6	August 31st ...	59	15	0
March 31st	57	0	0	September 30th ...	59	7	6
April 30th	57	10	0	October 31st	57	12	6
May 30th	60	17	6	November 30th ...	58	0	0

December 31st, 1909 ... £61 15 0

The range of price during the year has been remarkably small, considering the fluctuations of previous years—the margin between the highest and lowest prices recorded being only £9 12s. 6d. The highest price touched was £64 2s. 6d. on January 4th, 1909. The year closed with standard bar copper selling at £2 per ton less than at its commencement, and the first three months of 1910 have witnessed a further decline in selling value, the settlement price for March 31st, 1910, being £57 17s. 6d.

The question of special interest for the electrical engineer is : Will this low level of prices continue throughout 1910, or is an increase in price and approach to the level of prices attained in the years 1907-8 probable? The curve of price variations shown in fig. 2, covering the



Each vertical division represents £5 in price, each lateral division one year.

Fig. 2.—Copper Prices from 1895 to 1909.

period 1895-1909, is of special interest in connection with this question, for it shows that the collapse in price which marked the year 1901 lasted two years, and that a gradual improvement then set in, extending up to 1908, when another collapse in values occurred. *Now the curve of prices for the period 1895-1903 appears as though it would be repeated in the period 1903-10.*

It is, of course, not wise to press the similarity in the form and period of the price curves too far, especially in the case of a metal which is subject to so much stock market manipulation as copper. One may state, however, with some degree of confidence, *that the conditions which affect the situation all point to a rise in the price of copper during the present year.* Those of our readers, therefore, who are likely to require large amounts of the red metal for fulfilling contracts and orders during the present year and early in 1911, are advised to purchase for prompt and forward delivery at once at the prices now ruling in the copper market, and not to trust any of their advisers who would urge on them a waiting policy.

Hessle.—With reference to the proposal to transfer the E.L. prov. order to Hull T.C., the B. of T. has asked the U.D.C. under what authority it is proposed to effect the transfer. The Council has replied that if terms are arranged Hull T.C. will insert in its Parliamentary Bill a clause seeking powers to take over the order. Hull offers to pay £200 if Hessle Council will adopt electricity for street lighting.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Inspection of Coal Mines.

With reference to "Colliery Electrician's" letter under this heading, I did not think it necessary to point out, in an engineering journal, that the Boiler Explosions Acts make it obligatory on the part of a steam-user to have his boiler inspected by a competent person at least once in 14 months. This has to be done under a penalty, and the report filed for inspection by His Majesty's Inspector of Factories.

The Acts also give power to the Board of Trade to hold inquiries in cases of boiler explosions, and should the competent person have neglected his duty, inflict heavy penalties on such person and his employers.

The course I advocated in my last letter would place the same responsibility on the electrical inspector.

A "Government inspector," as advocated by "F. W. A.," would not be subject to any penalty, simply because no Government department can make a mistake!

The information asked for by "Colliery Electrician" is such as is only in the possession of the highest officials of the leading insurance companies. Whilst it is somewhat flattering to be coupled with these gentlemen, I regret (very much) that my finances do not in the least warrant such a supposition, and equally regret my inability to give the information he desires to have. This as regards Questions 1 and 2. However, I am acquainted with 23 collieries, of which 21 are insured with one or other of four companies for both boilers and electrical plant.

Re Question 3, has "Colliery Electrician" read the Home Office Rules, Electricity in Mines, Sec. 1, Rules 6 and 7?

Question 4.—So far as my experience goes the insurance men test with a testing set once a year, and with lamps or voltmeter, &c., at the other visits. I have also many times assisted in taking current tests and temperature rise tests.

Question 5.—Speaking again from my own experience, at a certain place, in the place of ropemen and deputies looking after underground plant there are now six good capable men engaged on the recommendation of the insurance company.

Question 6.—I always knew when the Government Inspector of Mines was coming, but I have often followed the insurance man into the pit, having heard from the engineman that he had gone in an hour or so previously, without wasting the time of anybody except a youth to show him the roads.

If Government electrical inspectors are appointed I do not think a single insurance man will lose his job, as the owners will still want covering against breakdowns, and I hope His Majesty's Inspector will not find so many faults that I shall lose my job—he won't if I can help it.

With further reference to "F. W. A.'s" letter, does he really think that if a Government Inspector had visited the West Stanley pit 12 months—nay, 12 days—before the explosion, it would not have happened? If he does, he is almost by himself. I contend still that the extra expense would not be justifiable, because a thoroughly capable staff is now in being and at work.

An insurance inspector would not be doing his whole duty if he failed to observe the cables and other plant not insured; because any failure of the insulation of these parts would put considerable additional strain on the insulation of the insured plant.

P. A. D.

Japanese Government Ignores British Electrical Manufacturers.

In your issue of March 4th, 1910, you devoted a certain amount of space to the Japan-British Exhibition. We quote from your article as follows :—

"Japanese eyes are now turned towards Great Britain for the supply of electrical appliances more earnestly than ever before, for they appreciate more and more the high quality of workmanship in British machinery, for (1) the machines get out of order comparatively seldom; (2) they are more

easily repaired and manipulated; and (3) they are durable. Our allies also acknowledge the high standard of business practice of Englishmen, and since the alliance the general feelings of the people are very favourably disposed towards this country."

In this connection we desire to bring before you the following facts:—

An important specification has recently been issued by one of the departments of the Japanese Government, from the approved makers' list of which English generator builders and motor builders are entirely excluded. The only firm put on the approved list, in spite of strenuous efforts on the part of English firms, are American, German and Japanese. We have recently seen a testimonial from the electrical engineer of one of the Japanese Government departments concerning a large number of motors made by a British firm. The testimonial reads as follows:—

"We have some 100 motors manufactured by Messrs. —, in addition to many motors manufactured by 15 other makers. Messrs. — motors have been continuously running for six years most satisfactorily. They did not give any trouble due to their construction or design. I assure you that they are of exceedingly good quality, construction, and workmanship."

In spite of this testimonial, which was seen by the consulting engineer to the department mentioned above, this particular British firm was refused a place on the list of approved makers. We think that such a state of affairs will come to you as news of the greatest possible interest in view of the Japan-British Exhibition, which will be open by the time you receive this letter.

There is a great deal of misconception with regard to the meaning of the word "reciprocity" in this country. The Japanese Foreign Minister has carefully explained publicly that there is no intention of having the best-favoured-nation clause in the treaties which will shortly be negotiated, and when asked what was intended by the Japanese Government with regard to conventional tariffs, stated that conventional tariffs probably would be negotiated with two European countries, but Great Britain would not be one of them because Great Britain had nothing to give Japan in return for any conventional tariff. Count Komura forgot that Great Britain *has* given to Japan everything, inasmuch as Great Britain has no tariff whatever against Japanese manufactures, but Great Britain does not guarantee that she will admit Japanese goods duty free in perpetuity. At the same time that Count Komura gave utterance to the above statements, pretty things were being said in London with regard to the furtherance of trade between Great Britain and Japan!

We leave to your readers the task of deciding whether British electrical trade is being treated fairly in this country by Government departments.

British Importers.

Japan, *April 19th*, 1910.

[We refer to this matter in our leaderette pages.—Eds. E.R.]

Electricity in Mines.

I agree with "Ivanhoe" in regard to the raising of the status of the colliery electrical engineer. The complaint is made from all quarters that colliery electrical engineers have not sufficient authority, and are underpaid. For this undesirable state of things the technical schools and the correspondence schools are mainly responsible. At most collieries a certain number of the motor attendants attend technical classes or take a correspondence course, then by means of influence, directly or indirectly, they become assistants and boast of what they can do. The chief electrician may fall ill, there are no serious breakdowns during his absence, and the manager thinks to himself, I can manage without so-and-so, and I will give so-and-so the job; if I give him about 5*s*. more per week than he is getting now, he will be satisfied, and this is how a good many colliery electrical engineers are made. Can anyone wonder why it is they are underpaid and have no real authority?

I will give one or two instances of the ignorance of some of the above class of colliery electrical engineers.

I went to take charge of the electrical plant underground at a large colliery in Yorkshire; the man who was leaving stayed with me a week to show me the ropes, and when he was showing me round he warned me not to touch certain motors or I should get a shock (these motors were not fixed in proper motor houses, but on the roadside or anywhere, often where it was damp underfoot). I asked why he had not got them earthed, but he did not understand me, and he was quite bewildered when I earthed each motor-starter and switches. That man to-day has a large plant under his sole control.

Another colliery electrician always maintained that the no-volt release on a shunt-wound motor-starter was in shunt with the field current, and no amount of reasoning would convince him otherwise.

In my opinion, every colliery electrical engineer in charge of a plant should possess a certificate which would show the possessor to have a good practical and theoretical knowledge, and should only be granted after, say, five years' experience as an assistant. I agree with "Ivanhoe" with regard to the Institution of Mining Electrical Engineers, and I cannot at present see how it is going to benefit the electrical engineer actually in charge of the plant.

Experienced.

India-Rubber Gloves for Extra-High-Pressure.

The replies to our letter in your issue of May 6th are certainly interesting, but it would appear that the St. Helens Cable Co. go rather further than deal with the then existing circumstances, viz., we were only giving comment upon the Coroner's remarks as to the use of ordinary rubber gloves in connection with 6,000 volts. The St. Helens Cable Co. point out the use of leather upon the palms and fingers of rubber gloves, and it is not desirable that the fact should be overlooked that we have made a speciality of this leather facing for gloves for years.

J. G. Ingram & Son.

London, N.E., *May 9th*, 1910.

Electrically-Driven Ring-Spinning Frames.

In the letter published in your issue of May 6th, under the above heading, a slight mistake has crept in. It is stated that a description of Messrs. Brown, Boveri & Co.'s system was first published in the *Textile Manufacturer*. I should like to point out that the matter was first published in the *Textile Recorder*, in a series of articles commencing in our issue of August 15th, 1908.

Frank Nasmith,
Editor, *Textile Recorder*.

Manchester, *May 7th*, 1910.

[A letter from the Oerlikon Co. arrived too late for inclusion in this section, and it appears in our "Notes" on another page.—Eds. E.R.]

Physiological Effect of Magnetic Fields.—In a recent communication to the Royal Society, Prof. S. P. Thompson described a physiological effect of alternating magnetic fields which he had recently detected. Using an alternating magnetic field of sufficient intensity and extent, produced by passing an alternating electric current round a specially-constructed magnetising coil, he succeeded in producing a visual effect which was subjective and physiological in such a way that it was detected by every person on whom it had been tried. When the head was inserted into the interior of the coil, in the dark or with the eyes closed, there was perceived over the whole region of vision a faint flickering illumination, colourless or of a pale bluish or violet tint. The period of the flicker was not well defined, but it seemed to have a frequency of 15 or 20 a second It was somewhat brighter in the peripheral region of vision than in the central part. Even in daylight, with the eyes open, the experimenter was conscious of a sensation of flicker superposed upon the ordinary vision. No effect on the senses of smell or hearing had been observed, but an effect on the sense of taste had been noticed. No after effects of any kind had been experienced either by himself or by others who had made experiments with him.—The *Times*.

The Aluminium Situation.—At the recent meeting of the Aluminium Industry Co., of Neuhausen, Colonel Huber, the chairman, stated that the situation in the aluminium trade was still obscure, the fight between producers continuing as hitherto. As a consequence the directors were compelled to exercise every reserve in referring to transactions in the metal. Nothing positive could be said, and he added that only the future could determine the course of circumstances. A day or two before this statement was made it was reported that the company had orders on hand for aluminium down to the end of this year, and that the company as a condition for again joining an international syndicate would require a tonnage share or allotment corresponding to its capacity of production.

COMMITTEE FOR PROTECTION OF ELECTRICAL INTERESTS.

The following circular, dated May 10th, has been received from Mr. R. Borlase Matthews (Hon. Sec.), of Bank Buildings, Kingsway, W.C.:—

Referring to previous communications on the subject of an organisation for the protection of the legislative and commercial interests of the electrical industry, I have now the pleasure to inform you that at a meeting held at the Savoy Hotel, London, on Friday, May 6th last—the Hon. Arthur Stanley, M.P., presiding—the undermentioned gentlemen were constituted a Committee for the Protection of Electrical Interests, and the following is an abstract from the rules which were adopted:—

1. The primary object of the Committee is to endeavour to secure united action with a view to the protection and advancement of the commercial and legislative interests of the British electrical industries, and for that purpose to take such steps as may from time to time appear advisable, and to co-operate, as far as possible, with all institutions, societies and associations, having similar or kindred objects.

2. The name of the Committee shall be the "Committee for the Protection of Electrical Interests," and may be shortly referred to as the "Electrical Committee."

3. The number of the Committee shall be limited to 80 members (besides the President, Hon. Treasurer and Hon. Secretary). Any casual vacancy may be filled by the Committee at an ordinary meeting.

4. Any gentleman connected with the electrical industry and receiving the support of not less than five members, shall be eligible for election by the Committee. Election shall be by ballot; two black balls shall exclude, there being not less than six members present.

5. Every member of the Committee shall pay an annual subscription of 1 guinea, to provide for the expenses of the Committee; and any member whose subscription remains unpaid more than three months after it becomes due shall be liable to have his name removed by the Committee from the list of members.

The Committee in its collective capacity starts with neutrality on all contentious matters.

Proposals for the election of a President, Hon. Treasurer and Hon. Secretary will be submitted at a meeting of the Committee to be held at an early date.

The Electrical League and the Electrical Industrial Association of Great Britain, referred to in former correspondence, will not now be proceeded with, and all subscriptions which I have received are being returned in full.

G. L. Addenbrooke, M.I.E.E.
J. F. Albright, M.I.E.E.
A. Bruce Anderson.
L. B. Atkinson, M.I.E.E., A.M.I.C.E.
A. K. Baylor, M.I.E.E.
Lieut.-Col. H. R. Beddoes.
H. R. Beeton.
E. Bergtheil.
T. Browett, M.I.M.E., M.I.E.E.
J. Cecil Bull, A.I.E.E.
E. Charrington, A.M.I.C.E.
Geo. Conaty, M.I.M.E.
A. N. Connett, M.I.C.E., M.I.E.E.
W. B. Cownie, C.A.
A. Dickinson, M.I.C.E., M.I.M.E., M.I.E.E.
Sydney Dobson, M.I.C.E., M.I.E.E.
Bernard Drake, M.I.E.E.
A. H. Dykes, A.M.I.C.E., M.I.E.E.
H. Justus Eck, M.A., M.I.E.E.
G. K. B. Elphinstone, M.I.E.E.
R. S. Erskine, M.I.E.E.
W. B. Esson, M.I.C.E., M.I.E.E.
S. Z. de Ferranti, M.I.E.E.
E. H. Freeman, A.I.E.E.
E. Garcke, M.I.E.E.
Wm. Geipel, M.I.E.E.
J. Barber Glenn.
F. E. Gripper, M.I.E.E.
Robert Hammond, M.I.C.E., M.I.E.E., M.I.M.E.
H. W. Handcock, M.I.E.E., A.M.I.C.E.
W. C. C. Hawtayne, M.I.E.E.
J. S. Highfield, M.I.E.E., M.I.C.E.
Hugo Hirst, M.I.E.E.
F. Hope-Jones, M.I.E.E.
E. M. Lacey, M.I.C.E., M.I.E.E., M.I.M.E.
J. G. Lorrain, M.I.E.E., M.I.M.E.
J. A. Lycett, J.P.
W. L. Madgen, M.I.E.E.
R. K. Morcom, M.A., A.M.I.E.E.
Sydney Morse, A.I.E.E.
W. C. Mountain, M.I.M.E., M.I.E.E.
W. M. Murphy, J.P.
Lee Murray, M.I.C.E., M.I.E.E.
F. H. Nalder, M.I.E.E.
Hon. C. A. Parsons, C.B., F.R.S., M.I.C.E.
W. H. Patchell, M.I.C.E., M.I.E.E.
A. Rashleigh Phipps.
Arthur H. Preece, M.I.E.E.
W. Llewellyn Preece, M.I.C.E., M.I.E.E.
W. R. Rawlings, A.M.I.E.E.
J. S. Raworth, M.I.C.E., M.I.E.E.
H. B. Renwick, A.I.E.E.
Theodore Rich, A.M.I.C.E., A.M.I.E.E.
J. R. Salter, M.I.E.E., A.M.I.M.E.
A. H. Seabrook, M.I.E.E., M.I.M.E.
Stephen Sellon, M.I.C.E.
A. M. Sillar, M.I.C.E., M.I.M.E., M.I.E.E.
J. F. C. Snell, M.I.C.E., M.I.M.E., M.I.E.E.
C. P. Sparks, M.I.C.E., M.I.E.E.
Hon. Arthur Stanley, M.P.
J. Grice Statter, M.I.E.E., A.M.I.C.E.
A. A. Campbell Swinton, M.I.E.E., M.I.C.E.
W. A. Vignoles, M.I.E.E.
F. J. Walker.
H. Laws Webb, M.I.E.E.
Joseph Wetzler, M.I.E.E.
W. B. Woodhouse, A.M.I.E.E., A.M.I.M.E.
A. P. Wood, M.I.E.E.

H. Foulds, F.C.I.S., A.I.E.E., Electrical Standardising, Testing and Training Institution.
Albert Gay, M.I.E.E., Associated Municipal Engineers of Greater London.
T. B. Goodyear, A.I.E.E., Metropolitan Association of Electric Tramway Managers.
L. G. Tate, A.M.I.E.E., Electrical Contractors' Association (Incorporated).
A. de Turkheim, Incorporated Association of Electric Power Companies, Tramways and Light Railways Association.
J. Glynn Williams, Institution of Mining Electrical Engineers.

Braunton (Devon).—The question of adopting a scheme of electricity supply has been left for a final decision by the ratepayers to the Parish Council, and as the members of that body are mostly in favour of the scheme, it is anticipated that it will be adopted. The company, which has the matter in hand, offers to supply electricity at 5d. per unit for lighting, and at 2½d. per unit for power, and 8s. per annum for a 32-c.p. lamp for downstairs use, and 4s. per annum for bedrooms.

LEGAL.

Hellyar *v.* Bale.

In the King's Bench Division, Mr. Justice Scrutton and a special jury heard this action, by which Walter Hanley Hellyar, a London solicitor, practising at Finsbury Pavement as Hellyar & Co., claimed as against John Henry Fooks Bale, of Cricklewood, formerly assistant chief electrical engineer to the Manchester Corporation Tramways, chief of the engineering department of the London General Omnibus Co., and electrical engineer to the Walthamstow District Council, damages in respect of shares taken by the plaintiff in the Muir's Patent Hub and Tyre Syndicate, Ltd.

The plaintiff's case was that on statements made to him by the defendant he was induced to subscribe for shares in the syndicate to the amount of £400; the defendant had told him that the company was in ample funds, that there had been orders placed with them by Garratts, Marcus De Dion, Carter, Paterson & Co., and others; that no such orders were placed with the syndicate; that at the time the syndicate only had £60 in hand, which was entirely insufficient for carrying it on; and that the shares had never been of any value.

The defendant denied that he had made all the statements that were attributed to him as having been made orally, and with regard to the printed statements as to the orders received, he said they had been received either by the syndicate or their predecessors.

The jury were unable to agree, and were discharged without giving a verdict.

United Exploration Co., Ltd.

Mr. Justice Swinfen Eady, in the Chancery Division on Tuesday, May 10th, heard a petition to declare the dissolution of the United Exploration Co., Ltd., void, on the ground that the company was a trustee under a debenture trust deed. It was stated that the company was incorporated in 1895, and became trustee under a trust deed in July, 1903, which secured debentures to the amount of £175,000, issued by the Electric Traction Co., of Hong Kong.

His Lordship made the order asked for.

Use of Electricity Pleaded as Defence to Patent Action.

In the Chancery Division on Friday, May 6th, Mr. Justice Joyce had before him the case of Coslett Anti-Rust Syndicate, Ltd., *v.* Lennox, in which the plaintiff company moved for an interim injunction in an action for alleged infringement of a patented process for coating metals so as to prevent rust.

Mr. Hughes, K.C., and Mr. Jennings appeared for the plaintiffs, and Mr. A. J. Walter, K.C., and Mr. Manning for the defendant.

Mr. Hughes said that no question of the validity of the patent could arise in this case, as the defendant was one of the assignors to the plaintiff company. The defendant raised two points—that the patent was invalid (which plaintiffs said he was estopped from claiming) and that he had not infringed the patent. But he (Mr. Hughes) submitted, on the evidence, including that of defendant himself, that he was infringing at the present time.

Mr. Walter said he was willing to offer the usual undertaking to keep an account.

Mr. Hughes: Will you give an undertaking not to infringe?

Mr. Walter: It depends upon how you construe the patent. This case involves a long and intricate question of construction, and there is strong scientific evidence on our side.

Mr. Hughes said he did not agree that the evidence was strong.

His Lordship: Infringement is denied?

Mr. Walter: Absolutely.

Mr. Hughes said that on April 10th, 1906, the patent was granted to Mr. Coslett, whose name had been given to the process. In June, 1907, he assigned a quarter share in the patent to the defendant Lennox and one-tenth to a gentleman named Moore. On December 20th, 1907, a company was formed for the purpose of taking over the whole of the patent, and Coslett, Moore & Lennox joined in assigning the patent to the company in consideration of vendor shares. Mr. Lennox became one of the directors, and up to December of last year it was said by him that, by verbal arrangement with the company, he was making use of the process for his own benefit. Mr. Lennox had ceased to be a director of the company, and was carrying on business as the Coventry Anti-Rust Syndicate, which (said counsel) involved the use of the precise process of the plaintiffs, or something very similar to it. The defendant in his affidavit did not deny that he used the plaintiffs' process, but said he had a right to, because the company had never revoked the right they gave him to use it.

Mr. Walter said he would give an undertaking not to use that process.

Mr. Hughes said he should like to know exactly what his friend meant.

Mr. Walter said he would undertake not to use any process in which electricity did not play a part. The defendant was using a process in which the essential part was the use of an electric current. The plaintiffs' process was not an electrical process in any sense. The plaintiffs were alleging that defendant's process was an infringement of their patent. He denied it, and refused to give any undertaking with regard to this electrical process.

Mr. Hughes: You are using our process plus the electric current.

His Lordship: That may be an improvement.

Mr. Hughes: If so we are entitled to it. We say defendant's process is a colourable imitation of ours.

Mr. Walter contended that there was no warrant by an assignor that a patent was valid, and nothing to prevent him subsequently challenging its validity.

His Lordship asked if defendant claimed the right to use plaintiffs' process under the verbal agreement.

Mr. Walter: Of course we do not. That had been put an end to by the issue of the writ. What defendant was doing was not an infringement of the patent.

Mr. Hughes said that the patent was of great commercial value to the plaintiffs.

Mr. Walter said an electric current could not pass through this process without making a chemical alteration in the substance. That was the effect of his evidence.

His Lordship said that as there was a serious question of infringement, and also a *bona fide* issue as to the validity of the patent, it would be contrary to practice to grant an interlocutory injunction. The defendant would keep an account, and there would be no order on the motion except the costs, which should be costs in the action.

Postmaster-General *v.* Tottenham Urban District Council.

In the High Courts on Tuesday, May 16th, before Mr. Justice A. T. Lawrence, the Hon. A. E. Gaythorne Hardy and Sir James Woodhouse, sitting as the Railway and Canal Commission, an application was heard on behalf of the Postmaster-General, who proposed to erect overhead telephonic and telegraphic lines in St. Anne's Street, Tottenham, against the Tottenham Urban District Council. It appeared that the Postmaster-General applied in the ordinary way under the Telegraphic Acts, 1863-1909, for the consent of the local authority to carry out the work, but he was met with a refusal, and then in accordance with a section of the Acts, the matter was referred to the County Court Judge of the district, his Honour Judge Wheeler, for arbitration. Having heard the parties, the County Court Judge gave his award in favour of the Urban authority. The Postmaster-General was not satisfied with this decision, and he, therefore, applied further to the Railway and Canal Commission under another section of the above Acts.

Sir Robert Hunter, solicitor to the Post Office, appeared on behalf of the Postmaster-General, and Mr. Freeman, K.C., with Mr. Munroe, were counsel for the Tottenham U.D.C.

Sir Robert Hunter urged that the award of the County Court Judge was unreasonable. The local authority, on the other hand, contended that having regard to the evidence which was produced before his Honour, his award was reasonable. It was to the effect that the Council had themselves converted overhead lines into an underground system at a cost of £3,500. This, they declared, was sufficient evidence that they considered the underground system better. And, furthermore, they had also laid down since 1899 new underground lines at an additional cost of £2,500, and further, the Postmaster-General himself had since 1899 applied to them for permission to lay down in the very same road underground lines for telegraphic communication, and these lines had been laid down. The difference in the outlay, which was the only ground alleged by the Postmaster-General for his application, was only £105. The Council further said that there was a danger in the overhead system, because of the narrowness of the street and the probability of the increase in traffic, the construction of tramways, &c. Dealing with these objections, Sir Robert said that as regarded the £105, it was really £113, but the real point was the principle involved, because the Postmaster-General was bound to consider economy and cost of outlay in these matters, because that cost was thrown upon the taxpayers, and he did not feel justified in going to additional expense where it could be avoided. Of course, this particular case was a small matter, because the line was a short one, but the decision of the County Court Judge might apply to other cases where the outlay might involve a much larger sum. If the ratepayers of Tottenham were willing to pay the extra cost of laying the line underground, of course, the Postmaster-General would be delighted to do it. With regard to the danger and inconvenience which was expected to result in the erection of posts for carrying overhead mains, he thought the question of danger was really negligible. It was also a curious fact that a larger number of accidents arose from the underground system than from the overhead system, owing to people tripping over the cable traps and falling into them when open, &c., but in the case of either system, accidents were not serious. Furthermore, there were already existing in this district overhead wires from house to house, and if these were safe, he contended that wires from pole to pole would also be safe. The District Council were not prepared to prevent the wires crossing the street from house to house which had been erected by the National Telephone Co. With regard to the objection of future traffic, it was very difficult to deal with speculative objections of this nature, but in the case of tramlines ever running along the road, the Postmaster-General was always willing to place his wires upon the trolley poles; in fact, it was a common practice in new tramway Bills to insert a clause giving the Postmaster-General that power. As to the width of the road, he contended that that was ample.

Major W. A. J. O'Meara, engineer-in-chief to the P.O., said the line in question was intended to be carried along the south side of the road on wooden poles 35 ft. high, and the object was to connect the P.O. with the police station, the Fever Hospital, and the Fire Brigade Station. There was an existing system, but it was one of divided maintenance, several corporations being responsible and such a system was open to serious objection. The wires were subject to interruption and being rendered unavailable when required. Further, if faults arose there was great trouble and delay in ascertaining on whose section of the system the responsibility lay. By the P.M.G.'s scheme this particular line would be under the control of the P.M.G. absolutely.

Further examined, Witness said that in short lines where they were dealing with very small quantities of electric current, it was difficult to locate faults by means of instruments. Of course where the service was longer and the electric current larger, the matter was easier. In connection with traction systems, there was a reduction in cost on overhead systems as against underground systems of £13,000 a mile, and although, of course, the figures would not be so large in the case of telegraph and telephonic lines, the ratio of the cost was about the same as between the two systems. In some parts of London it cost as much as £800 a mile to lay the pipes to take the underground wires. The public were crying for a cheap telephone system, but he did not see how they were to secure it upon such lines.

In answer to Sir James Woodhouse, Witness said that in regard to the underground system, there were difficulties which arose in cases of long-distance talk. The electrostatic capacity of the cables was not so great when laid underground, and their efficiency for long-distance talking was consequently limited. In America so well was this recognised that long detours were made round the cities in order to avoid laying the wires underground.

Cross-examined: Witness admitted that he knew of no case in Tottenham during the last 10 years where the overhead system had been allowed to be installed.

Mr. Freeman: There is no such case. Furthermore, it is a departure from the principle the Council have adopted. They have spent thousands of pounds in the last 10 years in order to get a uniform system in the neighbourhood.

At this juncture Mr. Justice Lawrence pointed out that the Tottenham Council had gone to considerable expense in preserving the underground system which they desired in their district, and he suggested the possibility of the Council making some offer to the Postmaster-General in the way of a contribution towards the difference in the cost, which would enable both parties to come to terms.

Mr. Freeman said his clients were afraid that the Postmaster-General would establish a precedent in this matter, and pointed out that he was attacking many districts in connection with the telegraphic and telephonic systems.

Sir R. Hunter said that many local authorities had already agreed to share the expense of an underground system by paying for the trenches, &c.

After some consultation, Mr. Freeman said that his clients were willing to meet the Postmaster-General, inasmuch as they would do the whole of the work for £50, which the Postmaster-General said would cost £84.

Sir Robert Hunter said he could not accept this offer, and the hearing proceeded.

Mr. Joseph Douglas Matthews, an architect and surveyor, who said he had practised in London for 45 years, described the property in the district through which it was proposed to run the line in question, and stated as his opinion that the erection of an overhead system would not in the least detract from the value of the adjacent property.

This concluded the case for the Postmaster-General, and Mr. Freeman then called Mr. W. H. Prescott, engineer and chief surveyor of Tottenham. Witness said his Council objected to the proposed overhead system because it was dangerous, and also because the authority had spent a great deal of money during the last 10 years in an endeavour to obtain a uniform underground system. The road and district in question was developing, and a few years ago the Metropolitan Tramways Co. deposited plans with the Tottenham Council for a tramway down this very road. He was of opinion that the P.M.G.'s estimate for digging the trenches, &c., for an underground system of communication was excessive. The Council had laid the underground system of telephonic, &c., communication, and they had found it much cheaper than the overhead system, in fact, it had turned out to be the best investment they had ever made.

Mr. Frederick Jenkins, who had been resident in the road in question, objected to the proposed overhead system on the ground of danger and unsightliness.

Mr. Eddington, superintendent of the Tottenham fire brigade, also objected to the system on the ground that the overhead wires would interfere with the working of the fire escape in case of fire in the adjoining houses.

Mr. Freeman and Sir Robert Hunter both addressed the Court.

Mr. Justice Lawrence, in giving judgment, said that he failed to see that any very great interest attached to the arguments that had been presented to them or the facts that had been proved. They found that it was impossible to lay down a principle in these cases, and all they could do was to consider the whole of the circumstances and then give the best opinion on them that they could. They felt most strongly the point urged by Sir Robert Hunter, namely, that the Postmaster-General must consider economy in these matters in order that telephonic facilities may be extended as widely as possible, and for his part in considering this particular case he could not find that the special character of this road would justify him in requiring the Postmaster-General to take a course he was disinclined to take if that stood alone. He did not see that there was any such danger in an overhead line as would induce him to say that it could not be put up with safety, nor did he think that the continuity

of the road would be destroyed by such a line, but in this case it was a very small matter, involving only about a quarter of a mile of line, and the community had got a very strong feeling on the matter. They had not only placed their own lines underground, but had actually taken down and placed underground a line that was overhead. The whole system in the district was underground, and had been so placed at a cost of some £6,000. Under those circumstances it seemed to him that this was a case in which one ought not to press the desire for economy against the views of the community, and, therefore, they thought that if the authority undertook to do the work of laying the pipes, trenching, &c., for £50, they ought to say that the system adopted should be the underground system.

The other Commissioners gave judgment to the same effect.

Sir Robert Hunter said that he understood that the conditions were to be part of the order.

Mr. Justice Lawrence said that the condition would be precedent to the order.

Mr. Freeman asked for costs.

His Lordship said that the costs were not within their jurisdiction.

BUSINESS NOTES.

Brussels Exhibition.—At the International Exhibition in Brussels the Société de Constructions Electriques de Charleroi is exhibiting a 1,200-1,800-H.P. electrically-operated winding engine, an 800-1,200-KW. electric pumping plant, and a 1,750-KW. steam turbine and alternator, all intended for the Bascoup Collieries (Belgium).

Buenos Ayres Exhibition.—The International Exhibition of Railways and Land Transport opens this month at Buenos Ayres and remains open until November next. We have received from the Executive Committee an illustrated circular containing some views of the buildings as they appeared during erection, and a good deal of general information for the use of exhibitors.

The Flight to Manchester.—The works of the Société des Moteurs "Gnome," where the motors were made which were used in Paulhan's flying machine, are equipped with a large plant of Messrs. Alfred Herbert, Ltd.'s labour-saving machines. It it thought that this may be some consolation to those who regret that the first flight from London to Manchester was not made by a British aeroplane!

Bankruptcy Proceedings.—Robert Brown, described as of Pear Tree Street, Goswell Road, E.C., late Parliament Chambers, Great Smith Street, Westminster, S.W.—Under this receiving order the first meeting of the creditors was held on Tuesday, May 3rd, at Carey Street, W.C.—Mr. E. Leadam Hough, Senior Official Receiver, who presided, reported that the debtor had been examined, and stated that in 1902 he became manager of the Traction Co. of the United Kingdom, Ltd, at Westminster. In 1904 a new company was formed under the style of the Traction Corporation, Ltd., of which he became manager at a salary of £500 a year. He remained with the company until December, 1908, for the last three years without remuneration. In 1906 he invented a surface contact system of electric traction, and took out patents in England and various countries. The patents were mortgaged to the amount of about £3,000, the whole of which sum went into the company. He estimated his unsecured liabilities at £2,129, the only asset disclosed being an equity of redemption in the patent relating to the surface contact system of electric traction, which was not returned as having any present value. The failure was attributed to the loss of an action brought by the Traction Corporation, Ltd., and the debtor, against the petitioning creditor in the bankruptcy for an injunction restraining the latter from using a patent. The debtor had contended that he should not have been made a party to those proceedings. After some discussion the meeting was adjourned until May 31st, to enable the debtor to bring in a scheme for the payment of a composition of 7s. 6d. in the £.

Samuel Walter Hart, described as of Hermon Hill, Wanstead.—The first meeting of creditors was held on Wednesday, May 4th, at the London Bankruptcy Court under a receiving order recently made. Mr. J. W. Chapman, Official Receiver, reported that it appeared from the debtor's statement that he was the original inventor and patentee of an electrical accumulator which he sold nine years ago to the Hart Accumulator Co., Ltd. He received the purchase consideration in shares, which he had since disposed of to creditors and other persons, and he was a member of the board of directors at a fee of £100 per annum. The statement of affairs had not been filed, but the debtor roughly estimated his unsecured liabilities at £3,000, and had assets, the value of which had yet to be ascertained, but which were expected to exceed the amount of the indebtedness. He attributed his failure to depreciation in the value of his shares and leasehold and freehold properties, and immediately to pressure by the petitioning creditor. In the absence of any offer, the case was left in the hands of the Official Receiver to be wound up in the ordinary course of bankruptcy.

Joseph Augustus Bauer, electrical engineer, trading at 17, Gracechurch Street, and 7 and 8, Great Winchester Street, E.C., as the Electrical and General Engineering Co. and as the Calux Electric Co.—The public examination was held recently before Mr. Registrar Hope at the London Bankruptcy Court. The statement of affairs submitted by the debtor disclosed total liabilities £4,978, of which £3,053 is expected to rank against net assets valued at £420. Witness attributed his insolvency principally to losses amounting to about £1,850 incurred in connection with the before-mentioned companies, to law costs and to the loss of the agency. The examination was concluded.

W. H. Durrant, electrical engineer, of Tonning Street, Lowestoft.—This public examination took place at Yarmouth Bankruptcy Court. The liabilities were £89, and deficiency £77. The debtor stated that having served his apprenticeship, he took a situation in London in 1903, but in 1906, owing to his health failing, he returned to Lowestoft and started in business on his own account, being then under age, with £5 capital and £10 borrowed from his father. In March, 1907, he joined in partnership with H. J. Parrish, having by that time lost his capital. Parrish put £80 into the business and advanced debtor the value of his stock, with which he paid off his creditors. For six months they shared the profits equally, and after that debtor was paid 7d. an hour and a tenth of the profits. In December, 1908, the partnership was dissolved. The business had been successful, but debtor practically had to come out, as Parrish had the stock and everything, and he was merely a servant. In January last he restarted in partnership with his brother-in-law, who put £50 into the business. That partnership lasted till September, since when he had traded alone, being at the time insolvent. He had done very little business, and getting into difficulties he tried to make an arrangement with his creditors, but failing, filed his petition. He admitted his partners had succeeded, but denied that he had handicapped himself by drinking and neglecting his work. The examination was closed.

Francis Hastings Medhurst (deceased).—At a meeting of creditors held on May 4th it was reported that the proofs of debt which amounted to £117,369, included the following among other claims:—Lord Armstrong, £53,642; Viscount Grimston, £8,534; Mr. P. Saunders, £37,423. Trustees were appointed to wind up the estate, and a committee of inspection was also appointed.

The first meeting of the creditors of John Filmer Davie, alleged to be a partner with W. H. Palmer (see this column last week) was held on Tuesday before Mr. E. Leadam Hough, Senior Official Receiver, at the London Bankruptcy Court. The receiving order was made on the petition of the landlord of the premises, 7, Great Castle Street, W., and that liability was stated to be the only claim against the debtor. The chairman reported that the debtor had attended before the Examiner and had stated that in September, 1900, he became manager for Mr. Palmer, who was then trading at 42, Castle Street, under the style of Palmer & Co. Apparently the debtor had made himself jointly liable for the rent of 7, Great Castle Street, but he had asserted that he had never been in partnership with Mr. Palmer, and had merely been employed to manage the business at a salary of £160 a year and 7½ per cent. commission on the net profits. In April, 1909, Mr. Palmer sold the business to Palmer & Co., Electricians, Ltd., and the debtor considered that his agreement to act as manager then came to an end. He was appointed a director of the new company at a salary of £4 a week, and held that office until the following August, when he resigned the directorship and left the company. The chairman added that he had seen the agreement in question, and apparently there was nothing in it to constitute a partnership. The only assets disclosed by the debtor were a life policy, valued at £12 10s., and a claim against Mr. Palmer for £65. He understood that steps were being taken to get the receiving order rescinded. In the absence of any resolution the case would remain in the hands of the Official Receiver, and in due course an application would be made to the Registrar for an order of adjudication in bankruptcy, when the debtor could put forward his appeal for a rescission of the receiving order.

J. G. Smith Cunnington, electrical engineer and contractor, lately at 7, Great Newport Street, London (separate estate).—May 24th is the last day for the receipt of proofs for intended dividend by the trustee, Mr. Alfred Page, 28, King Street, Cheapside, E.C.

W. S. Jenkinson, electrical engineer, Rodborough, near Stroud, Glos.—May 24th is the last day for the receipt of proofs for intended dividend to be sent to Mr. Chas. Scott, Official Receiver Station Road, Gloucester.

Liquidation.—Himalaya Electric Railway, Ltd.—A meeting of this company is to be held at 28, Chapel Street, Liverpool, on June 10th, to hear an account of the winding up by the liquidator, Mr. W. W. Turner.

F. B. Hellon & Co., electricians, 57, Moorfields, Liverpool.—Messrs. F. B. Hellon and H. P. Tavernor have dissolved partnership. Mr. Hellon will attend to debts and continue the business at the same address.

Osram Lamps for Exterior Lighting.—In Glasgow, during the recent gusty weather, a heavy sun blind fitted to the shop front of a small drapery establishment in Calder Road, Glasgow, became dislodged and fell upon two brackets supporting Osram lamps. The force of the fall—something over 4 ft.—was so great that it shattered the front board of the sun blind and permanently deflected the brackets at least 7 in. In spite of this, however, the filaments of the Osram lamps were not damaged, and are still burning.

Book Notices.—*Registration of Firms Bill.* By W. Bean. London: From the Author. Price 6d.—Besides the lecture named in the title, this brochure contains a variety of letters, essays, &c., relating to accountancy, banking and similar subjects. The author points out that nine-tenths of those adjudicated bankrupt never obtain their discharge, and regards these and fraudulent partnerships as cankers in British commerce. Registration of firms, which is almost universal abroad, would go far to remove these evils.

The Place of the Battery in Power Station Design.—Under this title the D.P. Battery Co., Ltd., of Bakewell, have issued an interesting pamphlet explaining the economies to be derived from the use of storage batteries in power stations, especially those of small or medium size with a bad load factor. An example is cited in which the generating plant consisted of Diesel oil engines coupled to 100-KW. dynamos, with a D.P. battery capable of discharging at 240 amperes for 3 hours. The station supplies tramways with a mean load of 150 amperes and peaks of 400. Without appreciable change in the output of the station the fuel bill was reduced 18 per cent. by the installation of the battery. There is an obvious slip in the statement that the fuel consumption was "580 lb. per B.H.P.-hour"! An example is worked out to show the net financial result of the adoption of storage, the first cost of the installation being reduced as well as the fixed charges and the running costs The application of storage to colliery winding, regulating A.C. loads, &c., is also dealt with.

"Science Abstracts." Sections A and B. Vol. 13, Part 4. April, 1910. London: E. & F. N. Spon, Ltd. Price, 1s. 6d. each.

We have received a copy of the first anniversary number of *Printers' Ink*, English Edition, which contains a great deal of matter of interest to all who are occupied at times with the many questions connected with modern and efficient advertising.

"The South Wales Wages Agreement," April 22nd, 1910. London: The *Colliery Guardian*. Price 1d.

"Compulsory Working and Revocation of Patents." By E. Lunge. London: Stevens & Sons, Ltd. Price 3s. 6d.

"Electric Power Plants." By T. E. Murray. 1910. New York: 55, Duane Street.

Journal of the Institution of Municipal Engineers. Vol. II, No. 1. April, 1910. London: The Institution. Price 1s.

"Engineering Index Annual for 1909."—The 1909 annual, which is about to appear, contains 471 pages, classifying and describing articles and papers from over 250 sources; a reduced price will be charged if orders are placed before May 30th with the *Engineering Magazine*.

The Engineering Standards Committee has recently issued report No. 7, revised March, 1910, on British Standard Copper Conductors; it can be obtained from the offices of the Committee, 28, Victoria Street, S.W., price 5s. 2d., post free.

"*Journal* of the Franklin Institute." Vol. CLXIX, No. 5. May, 1910. Philadelphia: The Institute. Price 50 c.

"Physical Review." Vol. XXX, No. 4. April, 1910. Lancaster, Pa.: The Physical Society.

"Bulletin Scientifique de l'Association des Elèves des Ecoles Spéciales." March, 1910. Liége: 23, Rue Agimont. Price 75 c.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVI, No. 4. April, 1910. New York: The Society.

Transactions of the Illuminating Engineering Society." Vol. X, No. 1. January, 1910. Easton, Pa.: The Society. Price 50 c.

Electricity in Textile Mills.—In a brochure received from the Allgemeine Elektricitäts Gesellschaft, Berlin, illustrations are given of their motors installed in textile mills, mainly on the individual-drive system, showing the great development of the electric drive on the Continent. Altogether, 55 installations, comprising 2,569 motors of 17,277 H.P., are referred to, several of these being situated in this country.

Catalogues and Lists.—Messrs. Wilkinson, Heywood & Clark, Ltd., 7, Caledonian Road, N.—Leaflet giving particulars of their Falcon brand baking and insulating varnish for use on armature coils, field magnets, field coils of arc lamps, and various electrical instruments; also of their Falcon insulating paint (air drying) for armatures, tramcar and feeder cables, transformers, outside lighting cables, and so on. The circular contains a copy of a report by the Electrical Standardising, Testing and Training Institution on tests made by them of both the varnish and the paint.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—The company has issued a quarterly "General Electrical Progress" publication of 16 pages, in which a variety of its electrical manufactures are described and illustrated. These include their feeder pillars for capstan control as supplied for use in India; stage and cinematograph arc lamps; G.E.C. electrically-driven vacuum cleaners, electric light fittings for shop window illumination, electric heating devices, Aron meters, wind direction indicators, and other lines. A complete list of the company's various publications is given for trade convenience.

The Felix Engineering Co., 143, Great Portland Street, London, W.—List briefly describing their "Labor" petrol engine for electric lighting and other purposes, which is supplied in sizes from 3½ to 5½ H.P.

Messrs. Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.—A finely-produced brochure of 68 pages has been published, in which there is given much interesting material regarding the works of the firm at Woolwich and Dalston. It is a production of which the firm may be justly proud, for it bears evidence of an effort to make a really "high-class job," as we say, from cover to cover. The numerous manufacturing and other operations carried on at Woolwich in the submarine cable shops and tank house, and in the india-rubber treatment, covering, spreading, taping, compounding, braiding and other shops, are illustrated by means of excellent interesting photographic half-tone views; shops devoted to the manufacture of lead-cased paper cables for telegraph and telephone, and for electric light and power, are similarly covered, a brief reference to the cabinet-making, joinery and pattern shops coming in between these and a fine set of views of the various sections of the apparatus department. The instrument calibrating and testing rooms, the landline department (batteries and line material), power house, engineering shops, laboratory, and the main offices at Woolwich are all included. The remaining section of the book is devoted to an account, equally well illustrated, of the various departments of the Tantalum Lamp Works at Dalston, with the lamp manufacturing operations—glass-blowing, winding, finishing, testing, and so forth—in progress. The power plant here is also described. For those who are concerned with Messrs. Siemens's manufactures at these two factories, the catalogue must possess abundant interest.

Messrs. Bromell Patents Co., Ltd., 52, South Castle Street, Liverpool.—Leaflet illustrating and briefly describing the Simplex water-tube cleaner for removing hard scale from the interior of boiler tubes, economiser or other pipes. The device has wheel cutters which act as guides to carry it spirally through the tube, and at the same time split up the scale as they go along. It carries a square tool at the entering end, which cuts away the rough unequal scale, and leaves a clear path for the revolving wheel cutters, which split and break up the remainder down to the surface of the tube.

Messrs. Poulton & Son, Reading.—New booklet giving dimensioned sketches and particulars of their patent "Curvilinear" boiler blocks for boiler seatings, flue covers, downtake blocks, serrated anti-radiation bricks, and all kinds of boiler brickwork setting.

Messrs. Henry Wallwork & Co., Union Bridge Ironworks, Roger Street, Manchester.—Twelve-page pamphlet containing a full description of their high efficiency worm gearing, its application and design, and of the method of testing employed. The illustrations show in half-tone and by line diagram a complete testing apparatus as described in the list. A second pamphlet (24 pages) gives information regarding their worm-reducing gears as applied to winches, haulages, pumps, &c. The opening illustration shows a group of motors with enclosed worm gears for the Japanese Government. A full-page picture shows worm gear drive applied to textile machinery, and another, across the centre two pages, shows 150-H.P. motor and worm gear drive which has been in operation for two years. Prices for cutting worm wheels are tabulated.

Messrs. Julius Sax & Co., Ltd., 24A, High Street, New Oxford Street, W.C.—Price leaflet of electric trembling bells, and postal card illustrating electric fittings with Holophane globes.

Messrs. Fielding & Platt, Ltd., Gloucester.—Illustrated list of their suction gas producing plants which are offered in sizes from 5 to 214 B.H.P.

Messrs Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—116-page fully-illustrated catalogue (No. 302), in a distinctive colour, enabling one to recognise it easily among a batch of others, particularising a large variety of electric light accessories. We shall not be expected to name a tenth of the things that are in this book, but the ground covered may be generally indicated by our saying that all sorts of things are described, including fuses, switches, wall sockets, ceiling roses, reflector lights for shop window lighting, water-tight and ships' fittings, wires and cables and flexibles, Climax conduits, arc lamps, and carbons, electric drills, fans, auto-transformers, measuring instruments, material for electrical illuminations, wiremen's tools and sundries. The new lines included in this catalogue comprise anti-jar lampholders, "flat" tumbler switches, self-locking wall plugs, anti-shock hand lamps, wireless cluster fittings, new qualities of lighting flex, and so on.

Messrs. W. N. Brunton & Son, Wire Rope Works, Musselburgh.—A new catalogue of handy pocket shape and size giving particulars of their mining wire ropes and fittings. For convenience the size has been kept down by excluding testimonials and so forth, so as to give in as small a compass as possible (40 small pages) particulars which may be useful to managers of all classes of mines. Notes on the handling and care of wire ropes are followed by a table of tests, table of inclines, tabulated wire gauges, breaking strains, diameters and weights of wires and ropes. Brunton's locked wire ropes and their patent "Kilindo" construction of ropes for winding and sinking, wire rope clips, detaching hooks and other fittings are shown, and directions for fixing improved wire sockets are illustrated.

Cluster Fittings.—Messrs. Tetley & Co., of Salford, are supplying a line of Cluster fittings for metallic-filament lamps. These they manufacture in all sizes for from one 25-watt metallic-filament lamp to four and six 300-C.P. high-voltage Sun type, and three 1,000-C.P. lamps. Among recent orders is one for a foreign Government.

Trade Announcements.—Messrs. Rhodes Motors, Ltd., have appointed as sole representatives in the South Yorkshire, Nottinghamshire, Derbyshire, &c., districts, Messrs. Renton, Holdsworth & Co., Ltd., of Norfolk Street, Sheffield, who have appointed as manager of their electrical department Mr. N. K. Thomson, who for several years represented Messrs. Dick, Kerr's manufactures through their Sheffield representatives.

Mr. Thomas W. How, of 15, Victoria Street, Westminster (the managing director of the Empire Roller Bearings Co., Ltd.), has been appointed manager and consulting director of the Horsfall Destructor Co, of Pershore, in succession to the late Mr. Arthur Greenwood. The business of both companies will be directed from the above London address.

For Sale.—The Ryhope & Silksworth Industrial and Provident Society, Ltd., is offering for sale, by tender, a quantity of old plant, including a complete electric lighting plant.

The Warrington Electricity and Tramways Committee have for disposal a quantity of old battery material.

Coventry Electricity Department is offering for sale four Lancashire boilers and an economiser.

Particulars in our advertisement pages in this issue.

Whitsun Holidays.—The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, announce that their works will be closed from Saturday, May 14th, to Wednesday morning, May 18th, for the holidays.

The Aston works and offices of the Electric and Ordnance Accessories Co., Ltd., will be closed from to-night until Wednesday morning, May 18th.

LIGHTING and POWER NOTES.

Atherton.—A correspondent informs us that Messrs. Fletcher, Burrows & Co., who own several collieries in the Atherton district, are about to adopt electrical winding at certain of their pits.

Birkdale.—The District Council has decided to light the Abbey Gardens with electricity, and has given instructions to proceed with the installation in Weld Road of alternate gas and electric lamps, so that a comparison of the cost can be made.

Colchester.—On Friday last a L.G.B. inquiry was held by Mr. H. R. Hooper, with reference to an application of the T.C. for permission to borrow £8,000 for new works. The Town Clerk stated that the proposed expenditure was partly in respect of two sums of £638 and £296 excess expenditure on previous loans, sanctioned in March, 1907, but the second and greater part of the loan related to new works in contemplation. About £2,700 was required for five miles of mains for districts in which a supply will be required in the immediate future. An expenditure of £1,125 would also have to be made for house services in connection with the mains. Two generating sets at the works had become too small for present requirements, and it was proposed to substitute others for them, if a purchaser could be found at a fair price; an outlay of £1,300 would be required. An expenditure of £960 was also required for the Hythe and Lexden sub-stations. Upon the advice of the Inspector, the question of the generating sets was left somewhat in abeyance and the loan application was reduced to £7,453.

Continental Notes. — Russia. — According to an American Consular report, the Riga municipal electrical plant has a capacity of 5,000 H.P., and supplies three-phase A.C. through an underground network. While a number of local engineering works have their own plant for electric lighting, private electrical plants for commercial purposes are not allowed. The charges for supply vary per hecktowatt-hour, from 1·7 cents up to 600 hours, to 0·8 cents per hour for over 1,500 hours. There is an electric tramway system covering 32 miles. The public electric lighting covers only one principal avenue, the harbour and railway station; elsewhere the streets are poorly lighted by gas.

A loan is being contracted by the Baku municipal authorities for, among other things, the purchase of the tramways and erection of an electric street lighting station. The population of the city is about 300,000.

Belgium.—La Société de l'Electricite du Borinage, of Patruages, which has just increased its capital to £78,280, has placed a contract for the addition of a 2,000-KW. steam turbine and alternator to its plant, which will then have a capacity of 4,000 KW.

Greece.—La Société Oravai, of Limni, has placed a contract with the Bergmann Electricitäts Gesellschaft, of Berlin, for the installation of a plant to utilise the water-power of the River Geranias, near Orovai, in the generation of electrical energy for lighting and power purposes in the town of Limni. A steam plant is also to be put down as a reserve.

Italy.—A new steam turbo-generator of 2,700 KW. capacity is being installed at the central station of the Societa Bolognese di Elettricita at Bologna. The company is reported to have entered into a contract to take its supply from a water-power plant as from July, 1912, on terms which show a considerable economy over the present cost of production.

A company has lately been formed at Belluno to put down a plant to utilise the water power of the river Boite in the generation of electrical energy for lighting and power purposes in the town. It is also proposed to construct an electric tramway between Belluno and Pieve di Cadore.

Norway.—The municipal authorities of Bergen are putting down a plant to utilise certain available water-power at Samnanger, about 25 miles from the town, for the generation of electrical energy for lighting and power purposes. The new plant, which will be an addition to, and not in substitution of, the existing steam-driven central station, will have a capacity of about 9,400 H.P.

Crewe.—In a statement to the T.C., the Chairman of the Finance Committee stated that the total cost of the electrical undertaking was £55,000, and he believed if it were sold now the Council would make a profit of £21,000. A sum of £1,219 represented last year's profit, and of this £500 had been handed over in relief of the rates.

Darlington.—The T.C. has applied to the L.G.B. for a loan of £1,500 for extensions to the condensing plant at the electricity works.

Farnworth.—At a meeting of the D.C. on May 4th, considerable disappointment was caused when it was announced that there had been a loss on the past year's working of the electricity department of £935, exclusive of the property tax, which in former years had been £60. The loss is stated to be due to a decrease in the receipts and increase in expenditure, also to the Council having spent over £6,000 in new plant recently, which is not as yet fully remunerative.

Gillingham (Kent).—The T.C. has agreed to the following terms for the supply of electricity to the Naval Hospital:—A flat rate of 1½d. per unit for power and heating, with a guaranteed minimum of 60,000 units for the first year, and 100,000 units per annum afterwards; and a flat rate of 2¼d. per unit for lighting.

Glasgow.—The Electricity Committee has recommended that 53,841 sq. yd. of ground in the east end district of Dalmarnock be purchased at 8s. per square yard, as a side for an additional generating station for the department.

Grays.—Acting upon the request of the L.G.B., the Council has decided to pay out of revenue the sum of £559, which was excluded from a loan for electrical purposes sanctioned on June 1st, 1905, on account of works that were then superseded. The Council has decided to apply to the L.G.B. for a loan of £900 for electricity purposes.

Harrogate.—The T.C. has unanimously passed the borough electrical engineer's scheme for an additional 500 street lamps to be converted from gas to electricity. Competitive schemes have been submitted by both the gas and electricity undertakings, and the saving by substituting electricity was found to be a very substantial one. The cost per post to be charged to the Lighting Committee for a 50-C.P. lamp—including renewals and all accessories—is 17s. per annum, the lamp being extinguished at midnight.

Hastings.—The Corporation decided at a meeting held last Friday to continue the scheme of substituting electric light for gas in all streets where cable is laid. Already the transformation has been carried out in many of the chief thoroughfares, and by the latest resolution another 240 gas lamps are to be immediately fitted for the electric light. Some years ago the Corporation purchased the whole of the lamp standards from the Gas Co.

Although the Gas Companies' Burners Bill has passed the House of Lords, the Hastings Corporation has resolved to continue opposition to the measure before the Committee of the House of Commons.

Heckmondwike.—The U.D.C. has decided to apply to the L.G.B. for a loan of £24,159, of which £19,959 is for excess expenditure, £3,000 for condensing plant, £1,000 for a cable to supply the works of the Bradford Dyers' Association, and £2,000 for connections.

London.—Fulham.—The net result of last year's working of the Electricity Department is a surplus of £4,717. The Electricity Committee, with a view to pushing electric lighting, recommends that £2,000 be spent in free wiring and fitting 500 consumers' premises for about six lights each; pre-payment meters are to be used, and (*a*) the Council will provide lamps upon the landlord agreeing to defray the cost of all renewals, except as regards fair wear and tear, the charge being 5½d. per unit, or (*b*) the tenant may provide lamps, and the charge will be 5d. per unit. It is proposed that the wiring shall be carried out by local contractors at schedule rates according to specification. A preliminary canvass in four streets has shown that 112 new consumers will at once adopt this system. The Committee also recommends that the Council should supply, fix, maintain, &c., outside shop lamps, of the metal-filament type, of 100, 200, 300 or 400-C.P. at inclusive annual charges of £2 10s., £3 12s., £5 2s. and £6 12s. respectively.

Hackney.—The Electricity Committee, with a view to more efficiently introducing the advantages of electricity to the public, has recommended that premises in Mare Street should be taken for the purpose of a showroom and offices of the Sales Department.

Metropolitan Asylums Board.—At the sitting on Saturday, the Asylums Committee submitted a report relative to the terms made in 1907 with the County of London Electric Supply Co. for the supply of electricity to the Tooting Bec Asylum. By the terms of the agreement the managers undertook for a minimum period of seven years to pay for at least 95,000 units per annum for lighting at 2¼d. per unit, and for 50,000 units for power at 1d. As the result of actual working it had been found that the Board was not using the minimum quantity, and various negotiations have taken place between the chief engineer and the company in regard to a re-arrangement of the terms. The Committee now reported that the company is prepared to waive the minimum consumption specified on payment of £932 spent in connection with alterations, and the engineer-in-chief suggests the provision of metallic-filament lamps at an estimated cost of £350, which he anticipates will reduce the present actual consumption for lighting purposes by one-half. The other terms will remain unaltered. This was agreed to.

Hampstead.—At the meeting of the Council on May 5th the Lighting Committee reported on the question of converting the whole of the street lamps from gas to electricity. Previous to December 20th last the inclusive charge per lamp-post per annum for a single upright incandescent burner was £3 4s. 9d. On the

date mentioned, the Gas Light and Coke Co. offered to equip the lamp-posts with inverted burners and fully maintain them at an annual charge of £2 19s. 10d. for the first five years, and afterwards at £2 15s. 8d. per post per annum. On February 24th the Lighting Committee of the Council offered to take over the lighting of the whole of the posts, convert them to electricity, and maintain them at a cost of £2 19s. 6d. for the first eight years, and afterwards at £2 0s. 2d. per post per annum. This offer was conditional on all the lighting being handed over, and there were already some 340 lamps lighted by electricity, while the Council had sanctioned the conversion of over 700 more, the materials for which were already largely in hand and the work was being carried out. The Gas Company now offered to substitute an improved inverted burner, which it guaranteed would give an average of at least 60 C.P., at an inclusive cost of £2 5s. for the first four years, and thereafter £1 19s. 6d. for each post. The offer had been referred to the Committee, which had now prepared a proposal as follows, subject to the whole of the lighting of the borough being converted from gas to electricity:—For posts fitted with two 35-watt lamps, £2 5s. for the first eight years, and £1 13s. 6d. subsequently; for posts fitted with four 35-watt lamps, or their equivalent, £3 5s. and £2 13s. 6d. (and 10s. per annum for every additional 35 watts). The following annual total cost of lighting the borough is based on there being 2,237 posts, fitted with one incandescent gas burner, or two 35-watt metallic-filament lamps. Present system, £7,242; inverted gas burners, £6,692 until 1915, and thereafter £6,226 (offer of Gas Company, December 20th, 1909). Electric incandescent, £6,655 until 1918, and thereafter £4,493 (scheme adopted by the Council, February 24th last). Inverted gas burners £5,033 until 1914, and afterwards £4,418 (offer of Gas Company, March 16th last). Electric incandescent, £5,033 until 1918, and afterwards, £3,747 (present proposal). The Committee recommended that the whole of the gas lamps in the borough should be converted to electricity under the scheme formulated. Councillor Simmons moved that the report be deferred back in order that the Council might avail itself of the Gas Company's offer to fit up a trial installation of about 20 inverted gas burners for observation. The amendment was carried by 18 votes to 17.

Middlesbrough.—At a meeting of the Electric Lighting Committee of the Corporation, on the 4th inst., the electrical engineer, Mr. H. M. Taylor, submitted the annual report, showing that the net profit for the year was £1,301, against £1,277 in the previous year.

Monaghan.—At the monthly meeting of the U.D.C. last week, a communication was read from Messrs. Curran Bros., Belfast, offering to install an electric lighting station, complete and in working order, for the sum of £1,970, and it was eventually agreed to proceed with the installation.

Newport (Mon.).—The Electrical Contractors' Association has sent to the T.C. a protest against the Corporation doing wiring work and supplying fittings in opposition to the tradesmen of the town. The Electricity Committee has replied, stating that electrical contractors have no reason for complaint, as it is not the general practice of the Corporation to undertake wiring work, and further that the Corporation has not exceeded its powers.

Penmaenmawr.—The U.D.C. has made application to the North Wales Power Co. for a supply of electricity in bulk, and has been informed by the company that it is considering the extension of its transmission lines, and would reply later to the inquiries. The B. of T. has consented to the extension for one year further of the order granted some years ago authorising the Council to supply electricity for consumption in the urban district, but the department points out that unless the Council arranges to carry out the provisions of the order it will be revoked at the end of the period without further notice.

Reading.—The T.C. has withdrawn its opposition to the Reading and District Electric Supply Bill, all clauses with reference to the supply of energy in bulk in the districts of the Wokingham, Bradfield and Wallingford Unions, and part of the area of the Henley Union are to be withdrawn, and other smaller concessions have been secured.

Rotherham.—The result of the working of the Electricity Department for the 12 months ended March 31st last was reported by the electrical engineer (Mr. Edward Cross) to be very satisfactory. He says that when all the circumstances are taken into consideration the results represent a higher standard than has ever been attained before. Notwithstanding the decrease of £181 in the value of the supply to the Tramways Department, there was an increase of £1,070 in receipts for power, and £80 for lighting. The total increase in receipts after deducting discounts and including meter rents and fittings surplus, amounts to £801. The balance carried forward to net revenue account is £6,917, as against £7,021 last year. This decrease of £103 is due to increases on the expenditure side. The new generating station at Wincobank was erected entirely out of revenue, and this together with the extra cost of running the station had a detrimental effect on all items included in generation charges. After deducting interest and sinking fund there remained a balance of £2,220 to be carried forward to appropriation account, which was a decrease of £176 on last year. Up to the end of March, 1909, the renewals fund stood at £9,728, and assuming that £2,000 of this year's profit is handed over for the relief of the rates and the remaining £922 was added to accumulated renewals account, then this fund would total £10,660, representing 18·4 per cent. of the capital expenditure.

South Africa.—Transvaal.—The Electric Power Bill which is at present before the Transvaal Parliament has aroused a very large amount of local opposition. In moving the second reading of the Bill the Attorney-General stated that the Victoria Falls Power Co., which was the largest power company in the country, now held both the electric power concessions in existence in the Transvaal, and had also entered into some 20 contracts with mines for the supply of power. It had also valuable holdings at Vereeniging and other parts of the Transvaal. In regard to the towns, the Bill provided that the consumer could obtain supplies from the power companies, unless the municipalities could show the Government that they were in a position to supply power at equally favourable rates with the companies. A special meeting of the Johannesburg T.C. expressed a strong opinion that the Bill should be amended so as to protect municipalities in regard to the supply of power in their own areas, except so far as mining operations were concerned. A town's meeting subsequently passed a unanimous resolution endorsing the resolution of the T.C. Several speakers emphasised the dangerous infringement of municipal prerogative proposed by the Bill, which made a board of Government officials the final authority as to the bodies which might compete with the Council within the municipality, and carry their mains along the streets, for whose maintenance the Council was responsible.

Cape Town.—It is proposed to spend a sum of £5,000 on the decoration and illumination of the principal streets during the festivities in connection with the opening of the Union Parliament. Of this sum the Corporation has agreed to contribute £1,500. Electrical energy for illumination purposes will be charged at the rate of 3d. per unit, this rate applying both to street illuminations and to the illumination of private premises.

Southend-on-Sea.—The T.C. has decided to extend the mains so as to supply the Kursaal, at a cost of £263. The Kursaal will require a supply for 1,000 lamps.

Stretford.—The Electricity Committee has adopted the following scheme of extension of plant:—One 500-kw. set of the existing type; one new boiler and economiser plant; surface condenser and filtering plant; repair and enlargement of battery; additional Old Trafford booster. Mr. Miller was appointed to prepare specifications, to advise on the tenders, and to attend at any L.G.B. inquiry, at an inclusive fee of £140. With a view to expediting the installation of the plant the General Electric Co., Ltd., the British Westinghouse Co., Ltd., the Lancashire Dynamo Co., Ltd., and Messrs. Edward Heaton & Sons; Messrs. Galloways, Ltd., and Messrs. Thomas Beeley & Son, Ltd., are to be asked to quote prices for a 500-kw. generator and a boiler respectively, similar in all respects to the plant recently installed.

Walsall.—Messrs. Lambert Bros., Ltd., have applied for an extension of mains to supply their proposed new works in Green Lane, Birchills. The Electricity Committee is endeavouring to secure such a number of consumers as will justify its asking the L.G.B. to sanction a loan for the extension. The L.G.B. has sanctioned loans for £8,345 for the following purposes: Purchase of land in Darwell Street, £1,000; erection of sub-station, £1,250; plant for sub-station, £1,404; mains, £3,691; services, £1,000.

Warrington.—At the T.C. meeting on Tuesday it was reported that the net profits on the electricity undertaking for the past year had been £1,691, against £493 for the previous year, and the net profits on the tramways £2,750, against £2,307.

Wigan.—At the T.C. meeting, on the 4th inst., it was reported that the electric light undertaking had realised £11,457 gross profits. With respect to the tramway undertaking, since the Coporation took over the tramways, the amount paid by the ratepayers has been £3,395, and it was shown that there was a loss of £7,863 in connection with the undertaking as a whole.

Yarmouth.—The T.C. had before it on Tuesday a lengthy report on the subject of the substitution of electricity for gas for public street lighting. The plan of the surveyor showed the town divided into 14 districts, and he suggested that during this year and next, four districts should be dealt with. The number of gas lamps in them was 193, costing £654 per annum. The cost of electricity would be £576, a saving per annum of £76. A further report showed that there are in the borough 186 arc lamps, costing £2,375 a year, and the surveyor suggested that they should be replaced by 400-C.P. metallic-filament and flame-arc lamps, by which a saving of £200 a year would be effected. The Council adopted the several recommendations.

TRAMWAY and RAILWAY NOTES.

Continental Notes.—Italy.—With the view that the inauguration of the exhibition at Turin this year shall coincide with the inauguration of electric traction on the Mont Cenis line—or, to be exact, the section from Bardonecchia to Modone—*L'Energia Elettrica* says it is in a position to state that a contract for a portion at least of the plant has already been signed with the Italian agents of Brown, Boveri & Co. The orders placed are for three 2,200-kw. three-phase transformers for reducing from 49,500

to 7,000 volts and three groups of rotary transformers for 7,000 volts. The machinery is to be all delivered by the end of the current year. The State Railway management has already acquired the posts and accessories for the electric equipment of the line, and has made arrangements so that the line can be tested at the beginning of next year. At the outset the 2,000-H.P. locomotive ordered for the Sivvi line will be used. This engine can maintain a speed of 45 km. an hour on a grade of 32 per cent., which is that of the Mont Cenis Tunnel. In the meantime an engine is under construction of 2,000-H.P. capacity, but adapted to attain a higher speed, which will be placed on the metals during the period of the exhibition.

AUSTRIA.—The district authorities of Aussig, in Bohemia, have decided to construct a 6-km. electric tramway from Pokau to Tellnitz at an estimated cost of 270,000 kr.

It has been decided to convert the railway network in the Province of Debreczin, Hungary, to electric working, and the works will shortly be begun.

Work is well in hand on the conversion of the horse tramways in the town of Agram to electric traction, and it is hoped that the principal line will be ready for operation in August next.

Progress is being made with the electrification of the Austrian State Railways, official announcement having been made that, of the several schemes contemplated, the Trieste-Opeina section would be first taken in hand. In consequence tenders were invited, returnable by the end of March. The heavy nature of the preliminary surveys was, however, such that all the firms interested requested and obtained prolongation of the term for submission till the end of May. The second section to be electrified will be that from the Prague terminus to Nusle. Comprehensive surveys and plans have been made, and if the conclusions come to are well founded, very considerable benefits in working will be afforded. The scheme is now undergoing an exhaustive investigation by the Government engineers.

SERVIA.—A new engine and dynamo of 1,050 KW. capacity has recently been installed at the power station of the Société des Tramways et Eclairage de la ville de Belgrade.

FRANCE.—La Société des Tramways de Dunkerque has recently acquired the horse tramway between Dunkirk and Saint-Pol-sur-Mer, and proposes to convert the same to electric traction as soon as the necessary formalities have been completed.

La Société des Chemins de Fer de la Haute-Vienne has recently secured a concession from the French Government for the construction and working during a period of 75 years of a system of electrically-operated local railways in the Department of Haute-Vienne. The lines will have a length of about 330 km.

RUSSIA.—A proposal to convert the horse tramways in the town of Bialystok to electric traction is at present under consideration.

BELGIUM.—Out of the 3,558 km. of railway worked by the Société Nationale des Chemins de Fer Vicinaux, of Brussels, 242 km. are electrically operated. Work is at present in hand, or about to be taken in hand, in transforming 300 additional km. to electric traction.

Batley.—At a meeting of the T.C. held on the 5th inst., it was suggested that the tramway system should be extended from the bottom of Hick Lane to the railway stations; it was stated that shortly a through service would be commenced from Dewsbury to Bradford.

Birmingham.—The tramway returns for the past year show that the net profit came out at £56,422. This is highly satisfactory in any case, and doubtless the ratepayers will derive additional satisfaction from the fact that £32,915 will go towards the relief of the borough rates. This result has been obtained despite the decrease in the number of hours worked by the staff, resulting in the yearly wages bill being increased by £8,000. The amount given to the relief of the rates is £3,500 more than was devoted to the same purpose in the previous year, and the increased balance is due principally to a general improvement of traffic which became noticeable early last autumn.

Bournemouth.—The first annual report of Mr. C. W. Hill on the Corporation tramways, recently submitted to the Council, shows total receipts amounting to £85,540 and working expenses of £55,677, leaving a gross balance which exceeded that of the previous year by £3,326. In the result, after meeting financial charges, a loss of £2,221 remained, as compared with a loss in the previous 12 months of £5,400. The manager points out that it will shortly be necessary to reconstruct the Poole track, and he estimates that the cost of the most urgent work could be met by the reserve fund; also, if a good year ensued on the tramways, it was possible that no call would be made on the rates for further reconstructions.

As mentioned last week, a proposal by the manager to abandon the conduit system has been made; a saving of £3,000 per annum is estimated if this were done, and the initial expense of providing trolley equipment would, with contingencies, amount to £1,910. This latter matter has been deferred for the present; the *Bournemouth Times* says that the adoption of the conduit system added some £50,000 to the original cost of the tramways.

Dunfermline.—The prov. order promoted by the Dunfermline and District Tramway Co. for extensions was before the Commissioners in Edinburgh last week and passed with some alterations. It was pointed out in the course of the inquiry that when the order was originally presented no less than ten different extensions were contemplated, but it transpired that the Wemyss Co. was also applying for power to extend its system. The companies met and considered the fields open to them. Rosyth naval base will be served by the extended tramways.

Glasgow.—As the result of the assessment appeal in connection with the Corporation tramways, the Lord Ordinary on the Bills (Lord Dundas) issued an interlocutor (1) sustaining the contentions urged on behalf of the Corporation that the tramway undertaking fell to be valued as a railway, and that, before fixing the valuation, there should be deductions made of one-half of the whole expense of maintaining or repairing (including "renewing") the permanent way; (2) finding the valuation for the year ending Whitsunday, 1911, to be the sum of £258,838, as against the sum of £278,070 brought out by the assessor; and (3) finding no expenses due. It is pointed out that, while for the year ending Whitsunday, 1911, the difference between the valuation proposed by the assessor and that contended for by the Corporation and fixed by the Lord Ordinary amounts, owing to the assessor's practice of fixing the valuation on the average of the previous three years, to only £19,232, the increase for the year 1911-12 (assuming that the total sum set aside for renewals remained unchanged) would, but for the Lord Ordinary's decision, have amounted to £38,465, and for 1912-13 to £57,697.

Handsworth.—The B. of T. has notified the U.D.C. that it is prepared to sanction the proposed loan of £19,150 for the purchase of the cable tramways, on the understanding that any sums realised on the sale of the Hockley depôt and power house shall be applied to the repayment of debt. The Board has also appointed as arbitrator, Mr. Alfred Lyttelton, K.C., M.P., his duty being to settle the terms of the lease of the cable tramways to be granted by the Council to the City of Birmingham Tramways Co., such lease to expire in 1911. The term of repayment of the loan has been fixed at 40 years.

Newcastle-on-Tyne.—A special meeting of the Tramways Sub-committee was held on the 5th inst., and had under consideration various details as to the promotion of a Parliamentary Bill by the Corporation in regard to the extension of the tramways either by a continuance of the present system or a series of routes of trackless trolley cars. It is suggested that the Corporation might seek powers for the extension of the system to Blaydon, Newburn, Coxlodge and Benton, and that a junction might be effected between the Scotswood Road and Elswick Road routes. A survey is to be made of the district at an early date.

Rossendale.—A Rossendale Tramway Men's Institute was opened on Monday evening in Bacup Road, Rawtenstall, the president being Mr. C. L. E. Stewart, the borough electrical engineer. Councillor Coupe, chairman of the Tramways and Electricity Committee, performed the opening ceremony.

Rotherham.—The annual report of Mr. Cross on the tramway undertaking shows that the traffic receipts have fallen from £31,483 to £31,058. Up to the end of November there had been a decrease of £996. In the remaining four months this decrease was not only held in check but reduced to £482, and he believed the rate of increase may be kept up during the ensuing year. The power costs have decreased by £182. The net working profit was £8,915, as against £9,920 last year. After deducting interest and sinking fund payment, the balance to be carried forward to renewals fund was £3,807, a decrease of £1,247 as against last year.

U.S.A.—The work of constructing the electric tramway line between Galveston and Houston was begun in March last, and, according to the report of the British Consul, it will probably be in working order in 1911, upon the completion of the causeway between Galveston and the mainland. The overhead trolley system will be used, and cars will run frequently between Galveston and Houston, a distance of 49 miles. The cost of construction is estimated at £312,500, exclusive of the amount to be paid by the company towards the construction of the causeway.

TELEGRAPH and TELEPHONE NOTES.

Congress of Telegraph and Telephone Engineers.—At the conference to be held in Paris this year, says the *Journal Télégraphique*, the following questions will be discussed:—Telephone exchanges, manual and automatic; rules and standards in telephony, to facilitate research; choice of telephonic apparatus; influence of neighbouring lines; long-distance telephony; preservation of wood poles; party-line telephones and telegraphs; and high-speed telegraphic systems.

Deferred Telegrams.—The Western Union and Postal Telegraph Companies, says the *Electrical World*, which recently adopted the "night-letter" system, under which telegrams are accepted at very low rates for transmission during the night, have experienced an enormous increase of business, which has strained their resources to the utmost. The innovation is stated by the general manager of the Western Union to have increased the number of full-rate messages also, the recipients of night letters often replying at once by wire. One man is known to have dispatched no fewer than 500 night letters in one evening; one Chicago house sent 1,109 letters at once, and two New York business houses sent 8,600 letters in one week. This unexpected development should be carefully noted, as it may exert a material influence upon telegraphic methods elsewhere.

Jamaica.—A Government motion to reduce the inland rate for telegrams from 1s. to 6d. for 12 words, inclusive of the address, and ½d. per word additional, passed the Legislative Council of Jamaica on April 21st. The Government is not yet prepared to take over the telephone company.

Marconi Continental and American Companies.—The Belgian Wireless Telegraph (Marconi) Co. has made a net profit for the year of 47,229 fr., compared with 26,706 fr. last year, and has declared dividends of 50 fr. on the ordinary, and 24 fr. on the founders' shares. The American Marconi Wireless Telegraph Co. has recently resolved to reduce the capitalisation of the company from $6,500,000 to $1,625,000, by reducing the par value of each share from $100 to $25. According to the *Electrical World*, the general manager stated that this reduction had been made in order to reduce the taxation charges levied upon the company in various States, where the assessment was made upon outstanding capital stock and not upon property. The annual report showed that the company's business was steadily improving; the increase in gross receipts was $25,523, and the increased cost of operation was not more than $1,000. The company has over 300 steamship stations in operation.

South America.—The Government of Venezuela has arranged for international telegraphic communication between Colombia, Ecuador, Peru and Venezuela, and it is proposed to extend the inter-Continental service to Bolivia, Chile, and the Argentine Republic. It is also stated that the Government of Venezuela has decided to establish wireless stations on the De Forest system at Pampatar, Coche, and Araya, Margarita Island, and on board the steamer *Venezuela*.

Uganda.—The Acting-Governor in the course of his report to the Colonial Office on the state of Uganda, states that the telegraph extension from Kampala to Fort Potal has been completed during the year, while an iron-pole line, carrying two wires, has been erected between Jinja and Kampala, replacing the previous line erected on growing ficus trees. There is now a complete iron-pole line between Mombasa and Entebbe, carrying two wires. The ficus-tree line has not been wholly satisfactory, though far more economical to erect. There are now 902 miles of telegraph wire in use in Uganda, and 45 miles of telephone wire, but the latter is, at present, purely for connection between Government offices, no public exchange having yet come into existence.

Wireless Telegraphy.—A wireless telegraph system has been installed at the submarine base, Dundee.

An association of men interested in wireless telegraphy has been formed in Sydney, under the title of "The Institute of Wireless Telegraphy of Australia."

Wireless Telegraphy from Air Ships.—The Zeppelin Air Ship Co. have recently carried out some wireless telegraph experiments, using the new Telefunken singing spark system, and have obtained some very satisfactory results. Full particulars will not be published until later, but the experiments up to the present have shown that with a comparatively simple laboratory form of apparatus installed on the Zeppelin air-ship signals can be readily given and received at distances up to at least 50 km. from the Telefunken Station at Nauen. It has also been found that the large mass of metal employed in the construction of this form of air ship enables considerably less sending energy to be employed for a given distance than is the case with the ordinary land stations or stations carried on other (non-metallic) types of air ship.—*E.T.Z.*

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Queensland.—June 8th. Six sections of common-battery switchboard and equipment, jumper wire, and cable, for the P.M.G.'s Dept. Tender forms, &c., at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

June 8th.—Protectors, small switchboards, and common-battery telephones, for the P.M.G.'s Department. See "Official Notices" April 15th.

New South Wales.—June 1st. Eight sections of common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" April 15th.

Two tons of wire, twisted pair, outside distributing, No. 16 S.W.G., for the P.M.G.'s Department. See "Official Notices" April 29th.

June 7th.—One main distributing frame, for the P.M.G.'s Department in Western Australia. See "Official Notices" April 29th.

June 14th.—100 party-line common-battery telephone wall sets; 10 party-line common-battery table sets; 100 switches, common-battery, single extension and intercommunication; and 3 000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" April 29th.

Brisbane.—June 22nd. Deputy Postmaster-General. Copper wire, insulators, battery material, &c. Local representation. Deposits may be paid at the High Commissioner's Office, 72, Victoria Street, S.W.

Austria.—May 21st. The Austrian Ministry of Public Works in Vienna is inviting tenders for the establishment of a telephone exchange in the Austrian capital.

Batley.—June 2nd. One lighting and traction switchboard for the Electricity Works. See "Official Notices" to-day.

Beckenham.—May 23rd. Wiring of houses, for the U.D.C. See "Official Notices" May 6th.

Belfast.—May 23rd. Motor boosters and switchgear, and extension of lighting switchboard, for the Corporation. See "Official Notices" May 6th.

Bishop Auckland.—May 25th. Electric lighting installation at the new infirmary, for the B.G.; F. H. Livesay, architect, Bishop Auckland.

Bulgaria.—The municipal authorities of Philippopoli are about to invite tenders for the establishment of a central electric lighting station and an electric tramway in the town.

Chile.—Tenders are invited by the Municipalidad de Talca for the provision of an electric tramway service in the city Particulars may be obtained on application to the Secretaria de la Alcaldia, Talca.

Clacton-on-Sea.—May 23rd. Electrical service fittings, bitumen and joint box compound, for a year, for the U.D.C.; G. T. Lewis, Town Clerk, Town Hall Buildings.

Copenhagen.—June 2nd. Two 1,000-kw. converters or motor-generators for the Corporation. See "Official Notices" to-day.

Cork.—Steam boiler with superheater, and electrically-driven feed pump, for the Cork Electric Tramways and Lighting Co., Ltd. See "Official Notices" to-day.

Coventry.—May 30th. One 2,500-kw. turbo-alternator and condensing plant, four water-tube boilers, two fuel economisers for the Electricity Committee. See "Official Notices" to-day.

Croydon.—May 26th. Electric lighting of two isolation pavilions and additions to Administrative block at Borough Hospital, Waddon. See "Official Notices" to-day.

Darlington.—May 25th. Condensing plant for the Corporation Electricity Committee. See "Official Notices" May 6th

Dartford.—May 18th. General stores for the E.L. department, and maintenance of fire alarms, telephones and connections, for a year, for the U.D.C. W. Kay, Clerk.

Dublin.—May 20th. Flame arc lamps and pillars, for the Corporation. See "Official Notices" May 6th.

Halifax.—May 14th. Electrical work at new police buildings, for the T.C.; James Lord, Borough Engineer, Town Hall (returnable deposit, £5).

Leicester.—May 25th. Mixed-pressure steam turbine, direct coupled to 750 kw. d.c. generator, together with condensing plant, switchboard, &c., and two Lancashire boilers, with fuel economiser, pipes, &c., for the Corporation Tramways Committee. See "Official Notices" May 6th.

London.—St. Pancras.—May 23rd. Twenty-one flame arc lamps, with 20 cradles, for the B.C. See "Official Notices" May 6th.

Newport (I. of W.).—May 30th. Providing and laying cables, and wiring for 100 points, at the new Isle of Wight Joint Hospital at Fairlee; H. E. Stratton, Clerk, 31, Pyle Street, Newport, I. of W.

Two 400-kw. motor-generators, one 600-kw. ditto, one booster, for the Electricity Committee. See "Official Notices" to-day.

Radcliffe.—May 14th. One 300-kw. continuous-current dynamo, for the U.D.C. Electricity Department. See "Official Notices" April 29th.

Rochdale.—May 25th. Accumulators, reversible booster and switchboard panels, for the Corporation Electricity Committee. See "Official Notices" to-day.

Tasmania.—Launceston.—June 13th: Overhead electric equipment of tramways for municipal authorities. June 27th: Synchronous motor-generators and battery, reversible booster, &c. Tenders in both cases to Mayor and Aldermen, Town Hall. Conditions, &c., from Town Clerk (one guinea deposit each specification).

Turkey.—May 28th. H.M. Consul at Constantinople (Mr. A. T. Waugh) reports that tenders are invited by the Turkish Ministry of Commerce and Public Works for a concession for the supply of electrical energy to the city of Constantinople. See this column of our issue of April 15th, for fuller particulars.

Uruguay.—July 4th. Twenty electric cranes, 1·5 to 5 tons, for the port of Monte Video. Particulars from the Administrative Council of the Port.

Wallasey.—May 30th. Alternating-current transformers, for the U.D.C. Electricity Department. See "Official Notices" May 6th.

CLOSED.

Belfast.—The Harbour Commissioners last week considered the recommendations of the Special Committee as to the supply of electricity, and certain tenders were submitted for consideration. It was recommended that a 65-H.P. Allen engine and dynamo, with the necessary wiring, masts, lamps, inspection boxes, switchboards, &c., be provided at a total estimated cost of £1,947, thereby enabling the electric current necessary for the lighting of the new Graving Dock, and certain new 15-ampere lamps, on Queen's Quay, to be supplied from the Commissioners' electric installation at Old Channel Road; that the tender of Messrs. Hind Bros. & Co. to supply 22 castings of bases for electric light masts for £2 15s. each, and the tender of Messrs. James Allan, Senior, and Sons, Ltd., to supply 22 tabular electric light masts for £156 15s. be accepted, as recommended by the Works Committee; and that the further consideration of the tenders for electric arc lamps be deferred to enable the engineer to make experiments with certain lamps. The recommendations were adopted.

Blackwood (Mon.).—The tender of Messrs. A. G. Arnold & Son, Newport, for the electric light installation at the new schools has been accepted by the County Education Committee.

Bristol.—The Corporation has accepted the following tenders:—

General Electric Co.—Annual supply of meters, £546.
Bruce Peebles & Co.—500-KW. converter for Underfall Yard Sub-station, £1,230.

Burmah.—The municipal authorities of Rangoon, Burmah, have placed an order with Leyland motors, of Leyland, for a petrol motor tower wagon for use in maintaining the overhead conductors of the electric tramways.

Burnley.—The Corporation has accepted the following tenders for electric motors and starters required by the electricity department for the year:—

British Thomson-Houston Co., Ltd.—Motors up to and including 3 H.P., and spare parts.
Dick, Kerr & Co., Ltd.—Motors of 4 H.P. and above, including 20 H.P.
Ferranti, Ltd.—Starters.

Buxton.—The U.D.C. has accepted the tender of Messrs. Ferranti, Ltd., for meters.

Dartford.—The U.D.C. has accepted the following tenders:—

Johnson & Phillips, Ltd.—Lead-covered paper-insulated cable, 900 yds. ·15 sq. in., and 450 yds. ·07 sq. in., £141.
The Universal Electrical Manufacturing Co.—One 12-way feeder pillar, £31.

Edinburgh.—The Bastian Meter Co., Ltd., have again secured the contract for 5 ampere meters.

Glasgow.—The Tramways Committee has recommended for acceptance the tender of the British Insulated and Helsby Cables, Ltd., for single-core lead-covered cable.

Heckmondwike.—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Co., Ltd., for cable for the extension of the supply to the Bradford Dyers' Association.

Italy.—The Italian Ministry of Public Works in Rome has just placed a contract with the Augsburg Maschinenfabrik Gesellschaft, of Nuremburg, Germany, for the supply of three electrically-operated cranes for the harbour at Naples.

Keighley.—The T.C. on May 3rd accepted the following tenders:—

E. Green & Son, Ltd.—Patent fuel economiser, with 93 tubes, £165.
British Thomson-Houston Co., Ltd.—Tirrill regulator, £250.
British Westinghouse Co., Ltd.—Transformer and switchgear, £246.

Lancaster.—The T.C. has accepted the tender of Messrs. E. Green & Son, Ltd., for the renewal of the economisers, at £120.

London.—L.C.C.—For shafting, bearings, brackets, pulleys, &c., for the second section of the central car repair depôt the tenders were:—

David Bridge & Co., Ltd.	(recommended)	£457
Smith & Grace Screwboss Pulley Co., Ltd.		553

Air compressor and receiver for the same depôt:—

Alley & MacLellan, Ltd.	(recommended)	£187
Reavell & Co., Ltd.		206
,, ,, (alternative)		230
Tilghman's Patent Sand Blast Co., Ltd.		247
Globe Pneumatic Tool Co., Ltd.		275
Peter Brotherhood, Ltd.		275
,, ,, (alternative)		245

The following tenders were received for the roadwork and platelaying, exclusive of the supply of rails and special trackwork, in connection with the reconstruction, on the underground conduit system of electric traction, of the existing horse tramways from Tooley Street, *via* Dockhead, Parker's Row, Jamaica Road, Union Road and Lower Road to Evelyn Street, Deptford, and the construction, on the same system of traction, of the authorised tramways from Evelyn Street, *via* Creek Road, Bridge Street and Church Street to Nelson Street, Greenwich. The tenders also contain provision for certain paving works outside the tramway tracks in connection with the widenings along the route of the tramways.

	Tramway works.	Paving works.	Total.
A. N. Coles, Paddington, W. ..(recommended)	£94,587	£29,089	£123,676
Dick, Kerr & Co., Ltd.	95,627	33,387	129,014
John Mowlem & Co., Ltd.	95,840	36,072	131,912
Kirk & Randall	98,857	35,063	133,920

Chief engineer's estimates, £98,665 for the tramway works, and £34,036 for the paving works, a total of £132,701. As regards the tramway works a provisional sum of £22,000 is included in each tender in respect of alterations of pipes, mains, &c., and £6,000 for any other contingencies which may arise. As regards the paving works £10,000 is included in each tender in respect of alterations of pipes, mains, &c., and a sum of £2,500 in respect of any other contingencies which may arise.

The acceptance of Mr. Coles's tender is recommended subject to assurances that the work will be completed within the prescribed time. Mr. Coles will sublet parts of the work to the following:—

Plough box covers and drain rail boxes.—Hadfield's Steel Foundry Co., Ltd.
Yokes and castings.—Anderston Foundry Co.; Staveley Iron and Coal Co.
Tie-rods, bolts and nuts.—Bayliss, Jones & Bayliss, Ltd.; Phœnix Bolt and Nut Co.
Jumper cables.—Callender's Cable Co., Ltd.; W. T. Henley's Co., Ltd.; General Electric Co., Ltd.

The following tenders were received for the supply of car-wheel tires:—

4,800 *steel tires for driving wheels*:—

	Per tire. s.	d.	Approx. amount. £
Russell Bros., Birmingham (Agents for Phœnix Aktien-Gesellschaft für Bergbau und Hüttenbetrieb Abteilung Ruhrort, Duisburg-Ruhrort, Germany)	17	1	4,100†
Geo. Schultz & Co.	18	10	4,530†‡
Cammell, Laird & Co., Ltd.	20	6	4,920†
John Baker & Co. (Rotherham), Ltd.	20	9	4,980†
Patent Shaft and Axletree Co., Ltd. .. (recommended)	21	6	5,160
Steel, Peech & Tozer, Ltd.	22	0	5,280
Steel Co. of Scotland, Ltd.	22	6	5,400†
Fried. Krupp, Essen-Ruhr (August Reechwald, agent)	22	6	5,400†
Henry Bessemer & Co., Ltd.	22	9	5,460
John Brown & Co., Ltd.	23	0	5,520†
William Beardmore & Co., Ltd.	23	9	5,700
John Batt & Co. (London), Ltd.	24	0	5,760§
Hurst, Nelson & Co., Ltd.	25	0	6,000†‖
Brown Bayley's Steel Works, Ltd.	27	6	6,600†
Vickers, Sons & Maxim, Ltd.	42	0	10,080¶
Taylor Bros. & Co., Ltd.	50	9	12,180†

1,603 *steel tires for pony wheels*:—

Geo. Schlutz & Co.	12	10	1,027†‡
Steel Co. of Scotland, Ltd.	15	0	1,200†
Russell Bros., Birmingham (Agents for Phœnix Aktien-Gesellschaft für Bergbau und Hüttenbetrieb Abteilung Ruhrort, Duisburg-Ruhrort, Germany)	15	5	1,230†
John Batt & Co. (London) Ltd. (recommended)	15	9	1,260§
Hurst, Nelson & Co., Ltd.	17	0	1,360†‖
Willam Beardmore & Co., Ltd.	17	5	1,393†
Steel, Peech & Tozer, Ltd.	17	9	1,420
Henry Bessemer & Co., Ltd.	17	9	1,440
Cammell, Laird & Co., Ltd.	18	0	1,440†
Fried. Krupp, Essen-Ruhr, Germany (August Reech wald, agent)	18	9	1,500†
Patent Shaft and Axletree Co., Ltd.	18	10	1,507
John Baker & Co. (Rotherham), Ltd.	19	0	1,520†
John Brown & Co., Ltd.	21	0	1,680†
Brown Bayley's Steel Works, Ltd.	22	6	1,800†
Vickers, Sons & Maxim, Ltd.	30	0	2,400¶

† Schedule as to rates of wages and hours of labour not filled in.
‡ Proposes to sublet to the Steel Works van der Zypen und Wissen, Cologne-Deutz, Germany.
§ Proposes to sublet to Bochumer Verein Stahlwerke, Bochum, Germany; and Vereinigte Stahlwerke van der Zypen und Wissener Eisenhütten A.G., Cologne-Deutz, Germany.
‖ Proposes to sublet to British manufacturers.
¶ Guarantees 8,000 miles per ⅛ in. radial reduction.

The schedule with regard to the rates of wages and hours of labour has not been filled in in the four lowest tenders submitted for the supply of the driving wheel tires, and there is the same omission in the case of the three lowest tenders for the supply of the pony wheel tires. The lowest tender in which information is supplied in the wages schedule is, in the case of the driving wheel tires, that of the Patent Shaft and Axletree Co., Ltd., at the price of 21s. 6d. a tire (total amount £5,160), and in the case of the pony wheel tires that of John Batt & Co. (London), Ltd., at the price of 15s. 9d. a tire (total amount, £1,260). The Committee accordingly recommend the acceptance of these two tenders. The total expenditure involved by the adoption of this course is £6,420 compared with £5,427, the total amount of the two lowest tenders.

The following tenders were also accepted:—
Electric lighting of Shelbourne Road School, Islington, Messrs. Johnson & Phillips, Ltd, £209.
Electric lighting of Camden Street School, St. Pancras, Messrs. E. Lawrance & Sons, Ltd., £251.
Electric lighting of Torriano Avenue School, St. Pancras, Messrs. Johnson & Phillips, Ltd., £233.

HAMMERSMITH.—The Electricity Committee received the following tenders for ducts:—

		One-way.	Three-way.	
H. R. Mansfield ..	(amended)	£160	£ —	2½ % dis. Late delivery.
Albion Clay Co.		182	254	2½ % dis.
Sutton & Co.		183	243	Complete delivery five weeks.
H. R. Mansfield ..	(accepted)	183	247	2½ % dis.
Wiggins & Co.		183	258	
General Electric Co.		195	—	
Sankey & Co.		252	339	

The engineer said it would be more economical and advantageous to lay the three-way ducts, so the tender of Mr. H. Mansfield for three-way ducts, at £247 less 2½ per cent., is recommended.

The following tenders were received for cables:—

Standard Cable Co...	£625	Made in Germany.
Union Cable Co.	658	Made in Germany.
Western Electric Co. .. .. (accepted)	660	Made in Woolwich.
Aubert Grenier & Co.	672	Foreign.
Callender's Cable and Construction Co. ..	700	Made in Erith.
Siemens Bros. & Co.	700	Made in Woolwich.
Johnson & Phillips	700	Made in Charlton.
British Insulated and Helsby Cables, Ltd. ..	705	Made in Prescot.
W. T. Henley's Telegraph Works	710	Made in London.
W. T. Glover & Co...	715	Made in Salford.
General Electric Co.	735	
Craigpark Electric Cable Co., Ltd.	949	Made in Glasgow.

The lowest tender for English-made cable being that of the Western Electric Co., that tender was recommended.

Bermondsey.—Correction.—We regret to find that an error occurred in our last week's list of accepted tenders for Bermondsey. The contract for ordinary meters (10 amperes and above) also for all two-rate meters required by the Council for the period ended March 31st, 1911, has been placed with Messrs. Ferranti, Ltd., of Hollinwood.

Manchester.—We print the following account of a recent meeting of the City Council from the *Manchester Guardian*:—"The Electricity Committee, the chairman (Mr. Howarth) stated, had accepted a tender from a Milan firm, through the General Electric Co., Ltd., for the supply of low-tension house service cable. The English prices asked were from 3s. 1½d. to 3s. 6d., against 2s. 3⅞d. by the Milan people. Mr. Howarth suggested that there was a combination among British manufacturers which had the effect of raising and maintaining prices, and by letting this contract the Committee saved £158. Objection was taken to the acceptance of the contract as contrary to the standing orders, seeing that the Council had no knowledge of the hours of work, rate of wages and conditions of labour in Milan. It was proposed to refer the matter back to the Committee, and as the votes were being taken Mr. Howell cried, 'Votes for England.' The proposal to refer back was lost, 29 voting for and 40 against."

Sheffield.—The Corporation has accepted the tender of Messrs. Steel, Peach & Tozer, Ltd., for 100 tons special section tram rails, at £8 15s. per ton.

Southend-on-Sea.—The T.C. has accepted the tender of Walter Scott, Ltd., of Leeds, for 50 tons of 40-ft. tram rails, at £7 per ton, plus 5s. per ton royalty.

Walsall.—The Electricity Committee has accepted the following tenders:—

Rees Roturbo Manufacturing Co., Ltd.—Supply of switchgear at the new transformer sub-station in Darwall Street, for £715.

Callender's Cable and Construction Co.—Laying cables for the new trunk main from Wolverhampton Street to Darwall Street sub-station, for £1,287; and extending the St. George's feeders and laying L.T. cables from Darwall Street sub-station to Lichfield Street and the Bridge, for £1,076.

Walthamstow.—The tender of Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, has been accepted by the Urban District Council for the supply of tantalum lamps.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

The following orders are announced:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, May 16th.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 9.30 p.m.

Tuesday, May 17th.—"B" Company. Company drill, 7 to 9.30 p.m.

Wednesday, May 18th.—Gymnasium, 6 to 9.30 p.m.

Thursday, May 19th.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 8 p.m.; technical drill, 8.45 to 9.45 p.m.

Friday, May 20th.—"D" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7.15 to 8.30 p.m.; technical drill, 8.45 to 9.45 p.m.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

Welsbach Incandescent Gas Light Co.—From a circular recently sent out to the shareholders of the Welsbach Incandescent Gas Light Co., Ltd., the *Financial News* quotes some interesting paragraphs in a leading article. It is stated that the past year "has borne the cost of special propaganda in connection with the launching upon the market of the new electrical section of the company's business, as to which it should be remarked that no capital expenditure has been incurred." In their conclusions the directors declare that it is imperative for a prudent board, carefully reviewing the situation as a whole and the new fields of enterprise, especially electricity, in which the company has been forced to engage by pressure of competition, to make provision for consolidating and strengthening the company's future position.

THE FREE TRADE AND TARIFF REFORM DISCUSSION.

We learn from Mr. Hawes, the secretary of the National Electrical Manufacturers' Association, that invitations have been issued to a large number of gentlemen, among them many members in the different classes of the Institution of Electrical Engineers, to attend the discussion on May 23rd. He understands, however, that some of these invitations failed to reach their destination. He will therefore be glad if anyone who desires to be present, but has not received an invitation, will communicate with him at Balfour House, Finsbury Pavement, E.C., when he will endeavour to accommodate him.

NOTES.

"Oerlikon" Individual Electric Drive for Ring-Spinning Frames.—The following letter has come to hand too late for inclusion in the usual place:—

"Though the letter in the columns of your valuable paper of last week over the name of Mr. A. C. Eborall is a literary production with an astounding lack of courtesy and business acumen, its childish prattle and the naiveté (with apologies to the Editors of the Electrical Review) of its wording might still serve a purpose, our purpose, viz., that of an unexpected but quite welcome advertisement for the Oerlikon system of individual drive for ring-spinning frames.

"To write at this place a lengthy technical argumentative treatise on the matter at issue would, we fear, strain the hospitality of these columns unduly.

"Suffice it, therefore, to state that we consider our position as quite unassailable and that our system is in many essential points different from that of Messrs. Brown, Boveri & Co., Ltd. We are also convinced that it is superior to the same.

"Mr. Eborall's contention that our system is a copy of the one he represents is mere empty bluff, and we are quite prepared to prove this at the proper place and to uphold the above-mentioned and other claims.

"We shall build, sell and install as many Oerlikon electric drives for ring-spinning frames as the market conditions permit, and we will accept of course the fullest responsibility for our contracts, also from a patent right point of view.

"The theory on which our system is based is not a new one; it is ridiculous to state that the description in the Electrical Review is an abstract of one of the Brown, Boveri publications. The laws governing ring spinning have been known for ages.

"We can only assume that Mr. Eborall makes his uncalled-for remarks due to the fact that he is ignorant of what has been done in this regulation of speed of ring-spinning bobbins by textile specialists, notably, Englishmen. Otherwise he would modestly admit that the combination of some however modern motor with a ring-spinning machine and some mechanical device, of which dozens have been patented, does not entitle anybody to broad patent claims, or a monopoly for electric ring-spinning variable-speed driving generally.—British, Irish and Colonial Department of the Maschinenfabrik Oerlikon, G. Wüthrich, *Manager*."

Electrical Football League.—The annual general meeting of the above will be held on Wednesday, May 18th, at the offices of the St. James' and Pall Mall Electric Supply Co., 19, Carnaby Street, Golden Square, W. All football clubs attached to firms in the electrical trade within 15 miles' radius of Charing Cross are invited to send two representatives, as the Council are anxious to increase the number of clubs. Full particulars of the League can be had from the Hon. Secretary, Mr. H. W. Roberts, 71, Queen Victoria Street, E.C.

Appointments Vacant.—Switchboard attendant, for the Paisley Corporation Electricity Works (£1); teacher of electrical engineering (15s. per evening), demonstrator in the electrical laboratory (6s. per evening) and teacher of wiremen's work (10s. per evening), for the Acton and Chiswick Polytechnic. See our advertisement pages in this issue.

Accidents due to Gas, Electricity, &c., in Germany.—The *E.T.Z.* gives brief particulars of the accidents recorded in Germany in 1909 due to the use of gas, paraffin, acetylene and electricity. There were 597 in all, of which 304 were ascribed to gas, 180 to paraffin, 23 to acetylene, and 90 to electricity. Of the gas accidents 125 were explosions. Fifty-four of the electrical accidents were due to contact with overhead wires, 12 to short-circuits, and 10 to carelessness. The fatalities numbered in the case of gas 146, paraffin 60, acetylene 9, and electricity 52; non-fatal injuries were inflicted upon 346 persons by gas, 117 by paraffin, 24 by acetylene, and 43 by electricity.

The Joint Publicity Scheme.—We are informed that the Electric Supply Publicity Scheme has now got well under weigh. The Joint Committee's aim is to issue publications which will finally cover the whole area of supply possibilities. The first step was taken by issuing a poster and showcard dealing with the use of the supply for general lighting, together with a typical circular with the same bearing; the whole of which we are assured was given widespread support by various undertakings, both London and Provincial. This has now been followed up by the issue of a poster and showcard illustrating electric ironing, forming the first of a series dealing with the uses of the supply for domestic purposes. The poster (40 in. × 25 in.), lithographed in five colours, is of a design to make an effective display on the hoardings. The showcard is smaller (15 in. × 20 in.), but of identical design and colouring, suitable for display in showrooms, offices, shop windows, estate agents' offices, &c. The aim of the present issue is to get people who are already using the supply for lighting to make use of it in other ways; in other words, the appeal is to consumers. In view of this, a handy sized and illustrated four-page folder has been got out, which, while compact enough to be slipped into the ordinary envelope enclosing accounts or correspondence, is yet comprehensive enough to touch on all the domestic uses for lighting, heating and cooking, onwards. Also with the same end in view, and as complementary to the poster and showcard, a mail-card has been designed, dealing with electric ironing. This is in a size for enclosing with correspondence (thus ensuring that it really gets into consumers' hands) and bears an apposite illustration reproduced in colours by high-class three-colour process.

Inquiry.—Makers of the "Standard Electric Vacuum Cleaner" are asked for.

I.M.E.A. Special Train.—In connection with the Convention of the Municipal Electrical Association next month, arrangements have been made by *Electrical Industries* for special saloon carriages to be reserved for members and friends who care to join their party by the 2 p.m. train from Euston to Glasgow, on Monday, June 13th. Tickets (fare and a quarter for the return journey), which will be available from Euston or either of five stopping places en route, can be obtained from our contemporary (37-38, Strand, W.C.)

A German Colliery Plant.—In a paper read recently before the North of England Institute of Mining and Mechanical Engineers, the electrical plant at the Shamrock Colliery, Westphalia, was described in some detail by Mr. H. M. Hudspeth. The installation is a very complete one, and consists of a generating station with three turbo-generators and condensers giving 4,300 KW.—*i.e.*, a 1,000-KW. Curtis-A.E.G. set, a 1,800-KW. Parsons-Brown-Boveri set and a 1,500-KW. Parsons exhaust steam turbine driving a Brown-Boveri generator, and supplied with steam from two Schwarz regenerative accumulators, which receive the exhausts from two main and two intermediate winding engines, two fan and five compressing engines.

The exhaust steam turbine plant is always running when the pit is working; during 1908 it generated 6,248,000 units (the cost of live steam to the rest of the plant is charged for at 2d. per unit), and its cost, including a proportion for buildings, cooling towers, &c., was £12 per KW.

The power station, which supplies three-phase current at 5,000 volts and 50 periods, is one of five belonging to the company, all being coupled together for supply purposes by some 46 miles of duplicate cable.

It should be mentioned that the lighting and power supply for a large district, in addition to the colliery supply, is carried out by this plant, some 34 million units being generated in 1908, of which 24 million were for colliery purposes.

Alternating-current transmission and motors are adopted throughout; above ground at 1,000 volts for motor supply and stepped down to 110 volts for lighting; at 5,000 volts for transmission to the underground distribution station and for supplying the main pumps, and stepped down to 1,000 and 110 volts for other underground motors and lighting respectively.

Three-core armoured cables are used for distribution, connected to machines through fuses in each phase and oil switches.

Underground motors in "intake" air are of the open-ventilated type, and in "return" air of the totally enclosed type.

The underground haulage is by means of 220-volt D.C. trolley locomotives, using the rails as the return circuit.

Power is supplied to these by two underground motor-generators, each of 65 KW. capacity, and coupled on the H.T. side to 5,000/1,000-volt transformers. Six locomotives are in constant use, and two are held in reserve; they were designed to deal with an approximate output of 2,116 tons per day, the average weight of coal per tub being ·55 ton, and work over four miles of road. The haulage costs, taken over 26 working days, allowing for interest and depreciation, with energy charged at ·30d. per KW., work out at 1·235d. per English ton of coal and 1·46d. per English ton-mile.

The main pumping in the mine is done by two high lift centrifugal pumps, each raising 600 gallons per minute against a head of 1,870 ft., and driven by 690-H.P., 5,000-volt, 50-cycle slip-ring motors, one of these plants being a reserve.

Further pumps of a similar type, and driven by 1,000-volt motors, are installed for unwatering lower seams, the cables providing for a supply at 5,000 volts if required in future.

Californian Hydro-Electric Power Houses.—Some interesting notes regarding power house design for the hydro-electric plants in California are given in a paper by Mr. J. C. Hayes, before the American Institute of Electrical Engineers. On the system described—namely, the Mount Whitney Power and Electric Co., there are three water-power plants, 1,350-KW., 1,500-KW., and 2,000-KW. respectively, and one auxiliary steam turbo plant of 1,000-KW. capacity. As usual on the Pacific Slope, the water-power plants are all situated on high head falls, the lowest being 360 ft., and the highest, now under construction, is 1,960 ft. The expenditure on hydraulic works is, therefore, at a minimum, and very little is done in the way of storage dams. The ditches or canals for carrying the water are lined with concrete 2½ in. thick and cement plaster ½ in. thick, a small amount of alum being added to the concrete and plaster to make it watertight. The ditch is excavated well into the mountain, very little reliance being placed on the filled bank. The flumes are of red wood and pine, and lead to the penstock, where there is a balance reservoir to even up the daily fluctuation of the stream flow, and give time to start up the auxiliary steam plant in case a flume breaks. Part of the reservoir is 5 ft. deeper than the balance of the reservoir, this being necessary as a sand trap.

Corrugated iron on a wood frame was used for the first two power houses of 1,350 and 1,500 KW., and this has been found sufficient, as the climatic conditions are so favourable, protection from rain being the principal requirement. Such buildings are, however, very cold in winter and hot in summer, and having a wood frame and windows, &c., they are not fireproof. The third power house of 2,000 KW. has, therefore, been built of reinforced concrete made of an open metal base plastered on each side with 1½ in. of cement, so that the walls and roof are 3 in. thick. A partition of the same thickness divides the generating room from the transformer room, and a similar partition divides the transformer room into two parts; the switch house is also of the same material. All the doors are fireproof, and the windows have metal casings with wired glass panes.

The generating plant in this third power house consists of two 1,000-KW. units, each consisting of a Pelton wheel operating on 1,135-ft. head, coupled to a three-phase alternator. Lombard governors directly actuate needle nozzles, and an auxiliary nozzle is provided which automatically opens in the event of the main needle nozzle closing too quickly and ramming the pressure pipe. Each of the two exciters is of sufficient capacity for both alternators, one being driven by a small Pelton wheel and the other by an induction motor.

There are seven transformers (one being a spare), each of 400-KW. capacity. The transformers are immersed in oil kept cool by water coils. The switchgear and wiring is so arranged that the transformers are in two banks. In the event of an accident to one of the transformers, one bank is disconnected, the cables and water-pipe connections of the affected transformer are removed, and the transformer is moved to one side, the bottom of its casing being fitted with rollers for the purpose. The spare transformer is then skidded into place, and connected up, the total operation taking about an hour. In the other power house the transformers are mounted on small trucks which run on rails, so that the transformers can be quickly moved about. In out-of-the-way situations, it is important to provide good housing accommodation for the power station attendants, and from a business point of view this has been found a paying investment, as much better men are obtainable.

Copper.—The supplies are at last beginning to tell in the case of this metal, prices being returned for the end of last month at £55 17s. 6d. per ton (Messrs. Merton's circular). Visible supplies amount to 110,207 tons, or a decrease of only 1,225 tons since the end of March, 1910. The appreciation since mid-month is mostly due to "Afloat from Australia." Supplies from North America to English and French ports are about half the average for the preceding 12 months; to other European ports they are about average. From Spain and Portugal supplies are low, but not inordinately so, from Chile about average, Australia above. (Return 4,300 tons, average 2,823 tons.) Reshipments to the States have not been made for four months.

The Copper Producers' Association announce (*Mining World*, of Chicago) an apparent, but not real, increase of production in March, as compared with February. On the daily basis, however, February turned out 4,025,444 lb., against March 3,873,144 lb. The figure for March is 120,067,467 lb., or 53,600 tons. The stock on March 1st in the United States is reckoned at 47,850 tons. On April 1st it is given as 55,270. The domestic deliveries during March were 62·8 million lb., as against 66·6 in February and 78·1 in January. Except in the remark about the decrease in production, the report is what one would expect. Germany, the electrical manufacturer, is more cheerful. Here the returns are:—Imports, 29,465; exports, 1,095; total consumed, 28,370 tons, compared with 23,019 tons for the same period in 1909. This return is from the same journal, made by L. Vogelstein & Co., of New York.

With regard to the combination, the Butte section is experiencing the usual little *contretemps* in the matter of adjustment of capital. According to an article in the *Mining World*, the Boston and Montana, producing over 40,000 tons of copper per annum, have agreed the amount of their exchange in Anaconda stock. The Butte and Boston, producing 9,000 tons of copper, besides silver and gold, appears to be contented, the Butte coalition doubtful, Washoe practically settled and the Trenton Mining and Development Co. is reputed to have obtained a good rate.

Electric Power at Messrs. Cammell, Laird & Co.'s Tranmere Works.

In a paper recently read before the Liverpool Engineering Society, Mr. J. H. Collie described the power plant and electrical installation at the Tranmere Works of Messrs. Cammell, Laird & Co., this being one of the most modern installations of the kind.

When the question was first considered, power gas was making considerable headway, and it was decided to utilise it for furnace heating, and driving the electrical, pneumatic and hydraulic installations.

Three 2,000-H.P. producers were installed, supplied by the Power Gas Corporation, of Stockton-on-Tees, who supplied the power plant. The fuel to be gasified is delivered into cast-iron charging hoppers immediately above the gas producers, and thence into cylindrical bells within the producers themselves, the charging apparatus being operated from a platform fitted above the producer.

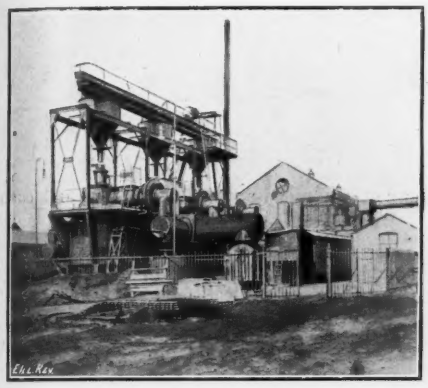


Fig. 1.—View of the Gas-Making Installation.

Fig. 2.—Overhead Transmission in the Works.

The gas leaving the producer is passed through a mechanical washer, two centrifugal cleaners working in series, and a sawdust scrubber, which effectively clean and cool the gas for use in the engines.

The producer blower is steam driven, and the exhaust steam is introduced into the air blast; a proportion of the steam for this and other purposes is obtained from special boilers heated by the gas engine exhausts.

The gas production is automatically controlled, according to the engine demand, a small gas-holder being provided which, acting as a governor, regulates the steam supply to the blowing engine, and so varies the amount of gas made.

The fuel used is a mixture of Lancashire special gas slacks costing 10s. 6d. per ton.

The costs of production shown below have been obtained by taking observations of the coal consumed during times when certain machinery and furnaces were not in use, and the author considers them approximately correct.

Week ending	Total B.T. units.	Power station wages.	Repairs.	Oil.	Stores.	Coal & producer wages.	Total cost.
Nov. 10, 1909	40,401	·0369d.	·016d.	·006d.	·005d.	·281d.	344d.
„ 17, 1909	41,278	·036d.	·014d.	003d.	·005d.	·270d	·328d.
„ 24, 1909	44,347	·033d.	·012d.	·005d.	·005d.	·262d.	·317d.
Dec. 1, 1909	49,905	·032d.	·012d.	·002d.	005d.	·24d.	·291d.

Average cost per unit for 4 weeks = ·320d.

During this period there was a night shift running with a light load, which made the cost higher than it would be on day shift only.

The guaranteed coal consumption per I.H.P. per hour was 1 lb. of coal, and the results on trial were slightly better than this.

The power station contains three 250-H.P. 140-KW. 440-volt compound-wound D.C. generators, two 400-H.P. 250-KW. generators of similar type, a third set being on order, two 260-H.P. air compressors, and two 80-H.P. hydraulic sets.

As regards the electrical plant, all the engines are of the well-known Premier horizontal scavenger type, the smaller ones having single and the larger, tandem cylinders.

The engines work on the well-known four-stroke cycle; the cylinders, pistons, piston rods and exhaust valves are water-cooled, and L.T. ignition is fitted, with duplicate sparking plugs. The engine governing is by varying the quality of the gas, and the engines are started up by compressed air at 200-lb. pressure.

The author remarks that the repairs are less than to steam engines of similar size, and one fitter usually does all repairs.

Fig. 3.—Interior of Messrs. Cammell, Laird's Tranmere Power Station.

As regards the electric supply, a mixed system is employed; alternating motors for constant-speed drives and direct-current motors for variable-speed drives. At Tranmere, direct current at 440 volts is used for power, and there is also an independent 220-volt three-wire D.C. lighting system.

The different types of motor likely to be required were

standardised for convenience, and made by the British Westinghouse Co., as follows :—

Constant speed motors. B.H.P.	Revolutions.	Variable speed motors. B.H.P.	Revolutions.	Crane type motors. B.H.P.	Revolutions.
4½	1,250	—	—	—	—
6	1,060	3½	600-1,800	8	680
8	700	5	500-1,500	13	640
13	750	—	—	—	—
*20	800	8	450-1,350	20	640
25	650	10	375-1,125	25	620
30	500	14	375-1,125	35	360
40	500	20	330-990	48	480
50	500	30	330-990	75	480
60	500	38	300-900	—	—
*80	640	52	325-975	—	—

The constant speed motors will stand an increase of speed from 20 per cent. to 50 per cent. by shunt regulation.

* In some cases the speeds have been made to suit special tools.

Compound-wound motors are used for most of the shipyard tools, as the heavy fly-wheels with which they are fitted, require a considerable amount of power to start. As far as possible, where machines have to be started and stopped frequently, they have been fitted with automatic starters, so arranged that a pull-and-push switch starts and stops the motor ; when the switch is pushed in, the circuit on the first step of the starter is completed, the motor starts slowly and winds up the starter, which is coupled up to one of the moving shafts by a small belt ; when the starter is hard over, the winding gear is automatically released. This arrangement is found to work very well and is as near fool-proof as it is possible to be.

A list of 20 of the principal motor-driven machines and motors in the shipbuilding sheds is given, including series motors of 104, 75, 50 and 13 H.P. for driving plate rolls (in connection with which the author favours the use of some form of liquid controller) ; a 30-H.P. compound-wound motor, driving a bevelling machine ; three 25-H.P., four 20-H.P. motors, &c., driving punching and shearing machines, &c.

One interesting motor drive is the Wet Basin Dock gates ; at the 90-ft. entrance there are four 20-H.P. series motors, driving, through friction disks, a worm wheel, which transmits the power through gearing to the chain drum.

The friction disks are set to slip when the motors are overloaded, allowing the gates to come up to the wall without jar and without opening the overload circuit-breakers.

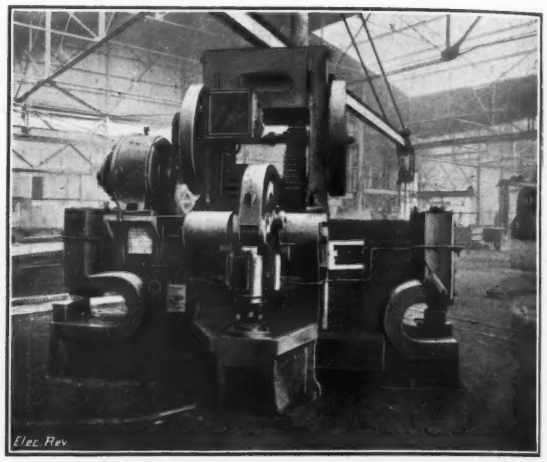


Fig. 4.—Punching and Sheabing Machine, Showing Motor Drive and Switchgear.

The controllers and rheostats are fitted in an underground concrete chamber and are operated from above by a portable key ; the reversing controllers are fitted with circuit-breakers, which in operating throw the controller drums into the neutral position. All four motors are controlled from the same chamber, a special multicore submarine cable being laid across the dock for the motors on the opposite side. A 150-ton revolving crane is fitted with a 110-H.P. motor for lifting, a 60-H.P. motor for jibbing and two 12½-H.P. motors in series for slewing ; and a 40-ton travelling crane is equipped with a 50-H.P. lifting motor, a 33-H.P. slewing motor and a similar sized motor for travelling.

In the engine shop a number of machines, especially large

Fig. 5.—Turbine Rotor Lathe.

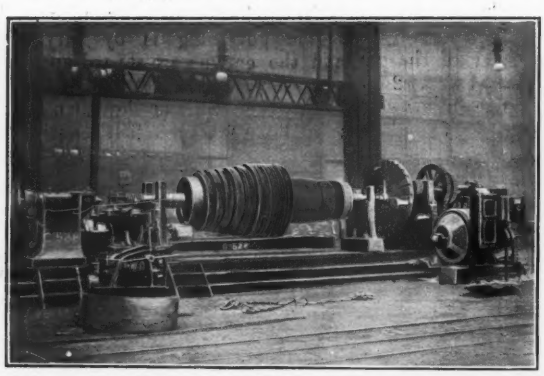
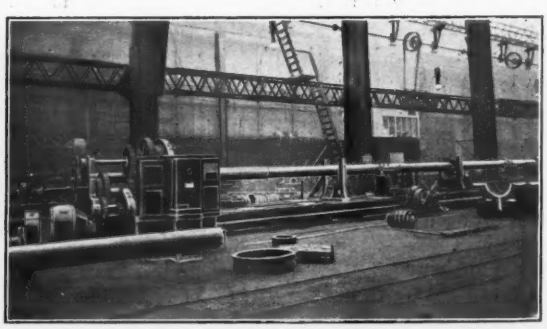


Fig. 6.—Shafting Lathe in Engine Shop.



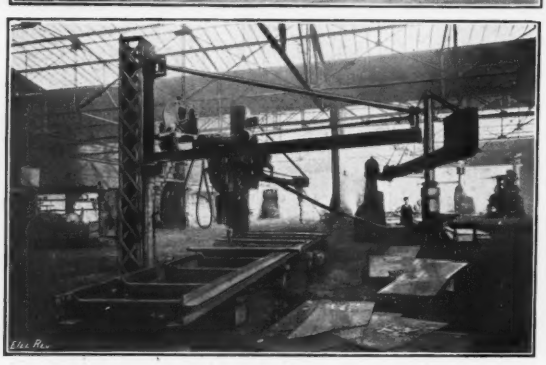


Fig. 7.—Countersinking Machine in Shipyard.

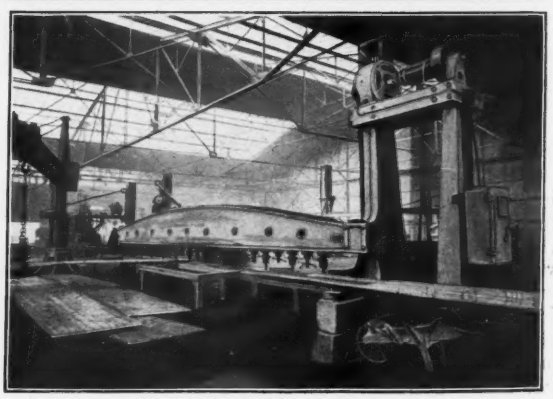


Fig. 8.—Plate-edge Planer in Shipyard.

ones of variable speed, and machines which are likely to run overtime, have individual drives.

Thus a turbine lathe is driven by a 60-B.H.P. variable speed motor and its saddle motion by a 13-B.H.P. motor; turbine boring, vertical and horizontal planing, and vertical slotting and planing machines are driven by three 40-B.H.P. motors; a 30-ft. planing machine is coupled to a 60-B.H.P. motor and its cross-cutting gear by a 25-B.H.P. motor; a 22-ft. planer by a 40-B.H.P. motor; a 36-in. centre screw-cutting lathe by 52 and 38-B.H.P. motors, &c., a list of 23 motors for this class of work being mentioned. In the boiler shop four motors of 30-20 B.H.P. are scheduled for driving planing and drilling machines; the joiners' shop motors number six, of from 50 to 13 B.H.P., and operate groups of two to five machines from underground shafting; in the saw mill the motors are placed under the floor in concrete pits, and also drive groups of machines, seven motors of from 80 to 5 B.H.P. capacity being installed.

The controllers are mostly of the ironclad self-contained type, with carbon make and break, positive overload release and magnetic blow-out, also a dash-pot to prevent too rapid switching on; push-button control is adopted when the controller is inaccessible to the machine man.

fibre tubes set in concrete, with drawing-in manholes every 100 yards. Spare ducts are left for future cables. These

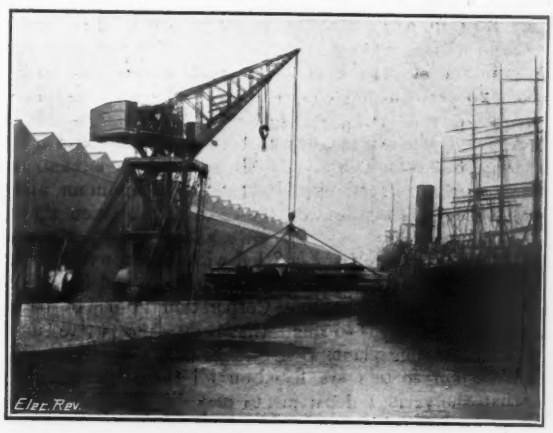


Fig. 9.—150-ton Electric Crane.

Fig. 10.—Main Switchboard, Tranmere Power Station.

Figs. 11 and 12.—Typical Line Shaft Drives in Carpenters' Shops.

The mains from the power station to the shops are ·6 sq. in. lead-covered paper concentric cables, drawn into

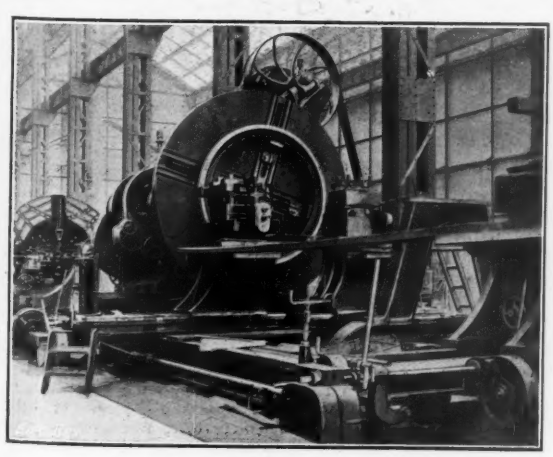


Fig. 13.—Turbine Lathe in Engine Shop.

mains terminate in iron distribution boxes, from which aerial cables with double-braided cotton covering, served with preservative compound and supported on insulators well out of reach of any workmen, are run to various groups of machines.

The cables from the shipbuilding sheds to the slips are covered with vulcanised bitumen, and are laid on the solid system, these supply a number of cast-iron distribution boxes spaced every 100 ft., from which power and lighting are obtained for ships during construction, and for supplying the electric winches used with the derricks.

In the engine shops the aerial cables are carried on insulators from column to column, and branches are tapped off and run down the columns to cast-iron drawing-in boxes and then through galvanised-iron piping to the motors; the piping is so arranged that any condensation taking place runs into the drawing-in boxes, and new wires can be drawn in at any time without disturbing the floor. Arrangements are made for four ring circuits of 500 amperes, each of these is controlled by a number of pushes indicated by red lamps, from where it is possible to shut off the current in case of emergency—the pushes operating circuit-breakers in the distribution boxes. On all the distribution boxes two

indicating lights are fitted, which are always burning when the power is on.

For the supply of power to the Birkenhead Iron Works, over a distance of about ½ mile from the power station, four ·6 sq. in. aerial aluminium cables are used ; these are strained on insulators mounted on post office telegraph poles. Aluminium at the time showed a saving in cost of about 20 per cent. on copper aerial cables, and answers the purpose quite as well.

As far as possible throughout the works the mains consist of aerial cables on insulators. These have the advantage of being cheap and reducing leakages to a minimum, and so long as they are kept out of the reach of workmen they are perfectly safe.

The main switchboard is fitted with the usual generator and feeder panels, also balancer, earthing and Corporation panels—the latter enabling Corporation power to be used when the demand is so small that it does not pay to run the works generating plant.

Watt-hour meters are fitted on all the outgoing circuits, so that the various departments may be charged with the power used.

Supply of Power to the Old Works.—The small steam-driven generating station at the Birkenhead Iron Works has been shut down and a supply taken from the Tranmere Gas Station. As the voltage at Birkenhead was 240, motor-generators had to be installed ; these are of the three-wire balance type, having an overall full-load efficiency of 92 per cent., which, with a line loss of about 6 per cent., gives a total efficiency of 86 per cent. The two steam sets are kept as a reserve plant.

For the Dry Docks there is a separate steam-driven plant, with two Sterling boilers, and two 42-in. Tangye pumps, which can empty a dock in four hours ; also a 12-in. drainage pump, two steam-driven 120-KW. electric generators for dock lighting and electric capstans and one steam-driven air compressor for pneumatic tools.

In conclusion, we are indebted to Mr. Collie for the illustrations and curve published herewith.

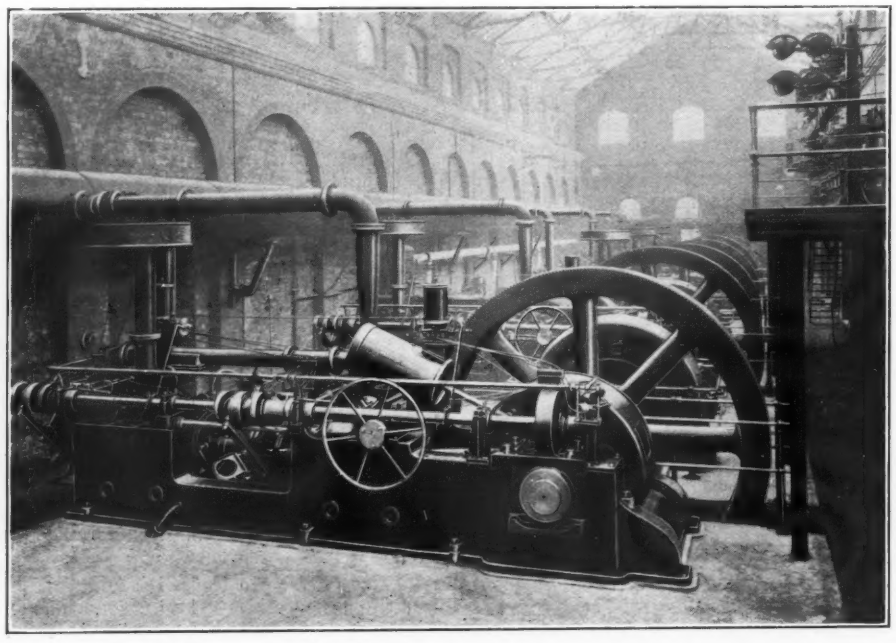


Fig. 15.—Tandem Scavenger Type Campbell Gas Engines, Tranmere Power Station.

Brighton Pavilion.—The T.C. has adopted the recommendation, mentioned in the Electrical Review last week, to overhaul and put in order the E.L. installation at the Pavilion. The work will be carried out by the Council's staff.

APPARATUS FOR WORKS EQUIPMENT.

Messrs. Garty, Bone & Co.

A new commutator grinder has been brought out by this firm, which, being of small size, can be attached to grind up the commutators of semi-enclosed machines with end plates, as well as those of machines with pedestal bearings. The emery wheel can be driven by a belt from the commutator to be ground, or independently by a separate small motor of ½ H.P. When the latter is used, the grinder can be utilised for grinding up the commutators of large motors by detaching the belting or gearing, and revolving the armature slowly by hand. The frame of the grinder consists of a casting, with suitable slots for bolting on the brush rocker, or other part of a machine. On the upper part is placed a worm-wheel and worm, giving a fine forward feed. The makers have used it for grinding up some very badly worn commutators, and find it has a remarkable power of quickly removing metal. The illustration on p. 787 represents a commutator, 13 in. in diameter × 12 in. face, running with copper brushes, and about ¼ in. off the truth, which was ground up true in two hours, including the time taken in getting ready.

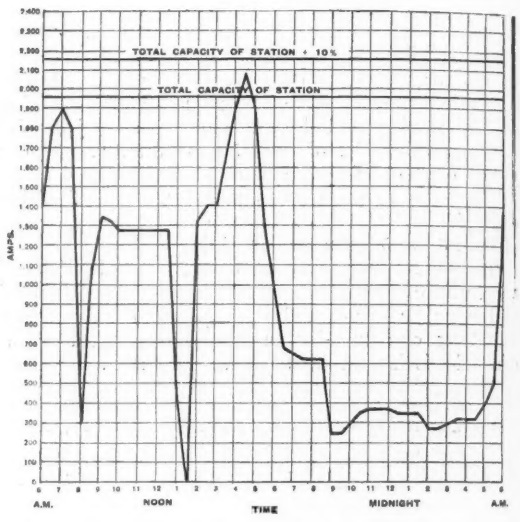
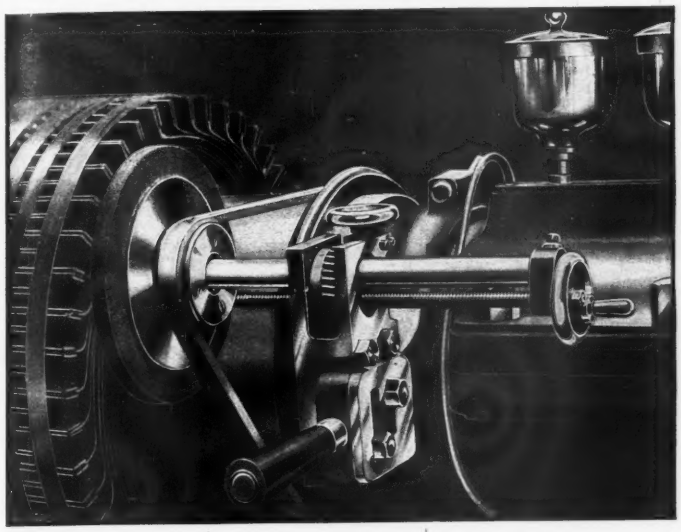


Fig. 14.—Load Curve, November 25th, 1909, Tranmere Power Station.

Western Electric Co., Ltd.

The telephone is now practically indispensable as an aid in the management of large business concerns, where it is necessary that a number of departments shall be constantly in touch with one another; it should, however, always be borne in mind that heavy demands are usually made on such instruments, and reliability and durability are of vital importance, otherwise the system will be of no material benefit.

A new series of metal telephones has recently been introduced by the Western Electric Co., Ltd., of London, which possess the above-mentioned essentials in a high degree, and are designed in accordance with practical experience gained in the manufacture and working of telephone instruments extending over many years.

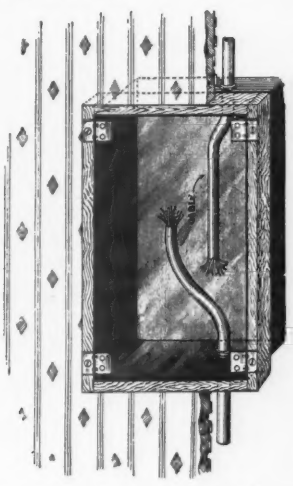


Commutator Grinder (Garty, Bone & Co.)

The Western Electric Co.'s "Inter-phones" are, as the name suggests, of the direct intercommunicating type, no switchboard and no operator being required. The pressing of one button gives the calling signal and makes connection with the line desired; no other movement is necessary. When answering a call, one button is pressed, and the connection is thus completed. Nothing could be simpler!

The new flush-type wall pattern is of special interest, being designed for sinking into the wall of the building; the wiring is entirely concealed, and the face of the instrument projects but a few inches. When a building is under construction, the back portion of the set, which is in the nature of a cable terminal box, is fixed into the wall flush, and the cable is led into it from above or below. Any plastering or papering may then be proceeded with, and the front portion carrying the working apparatus is screwed on when all is dry and the decorating of the room complete. The instrument may, of course, be installed in any finished building with little trouble.

Western Electric Table Pattern Inter phone.



Method of Mounting the Back Portion (Cable Terminal Box).

What is known as a non-flush type is also made, and is fixed on the face of the wall in the usual way; all fixing lugs and screws are, however, invisible.

A table pattern, as illustrated, is furnished for private rooms or offices, if desired.

The company's central-battery system is employed, the ringing and speaking batteries being all located at one spot and out of sight.

The external finish is non-chipping matt black japan, with nickel-plated fittings. This should harmonise with the decorations of almost any office, and at the same time would be quite suitable for the workshop or store.

Further particulars are given in the company's Bulletin A-4,002, which will be sent to all those interested.

Flush Type Western Electric Inter-phone, Open for Inspection.

Messrs. Drake & Gorham, Ltd.

A magnetic clutch, which has been extensively adopted in up-to-date workshops, shipyards, &c., forms one of Messrs. Drake and Gorham's specialities. The clutch consists of four magnet coils secured on to the body, which is keyed on the main shaft. The ends of the coils are connected to two insulated grooved rings, to which the current is conveyed by carbon contacts.

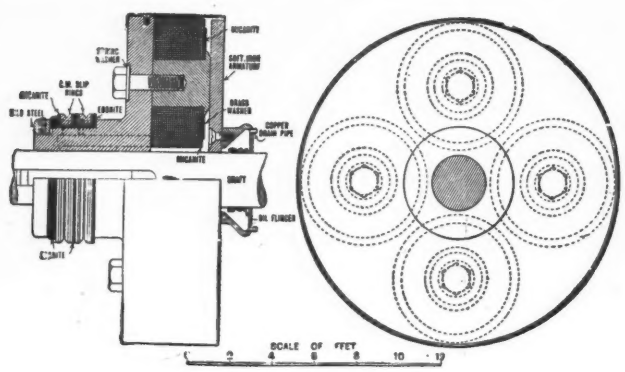
The armature, which is of soft iron, is fixed to the pulley to be driven.

From a number of tests which have been conducted by different authorities in workshops of all classes, it has been found that the saving of power by the introduction of electric driving by motors of moderate size and high efficiency averages 35 per cent. It has, further, been found that an average saving of 20 per cent. can be made by abandoning the horizontal countershafting for each machine driven from the main shaft, apart from the considerable saving in maintenance of belts and the improvement in general lighting which results when the pulleys, striking gear, and horizontal belts are removed. It is admitted that the most economical results are usually obtained by driving a certain number of small tools from one motor, and it is therefore evident that to obtain the full advantages of electric transmission, the

Flush Type Inter-phone, showing how the Instrument is Sunk into the Wall.

magnetic clutch becomes an important adjunct. Even in cases where the initial outlay prevents manufacturers from making the change to electric transmission, a net saving of 20 per cent. in power can be effected by the adoption of magnetic clutches and the system of driving shown in the illustration below.

Careful tests were made of a shop driven by electric power, before and after the change, and with no alteration in the tools driven, or the working conditions; a net saving of 50 per cent. resulted, and the reports of the workmen are to the effect that they much prefer the magnetic clutch to the fast and loose pulleys previously employed. Besides the application of this magnetic clutch to shop driving, there are many useful applications of it to individual machines, such as planing machines, thereby enabling the cross-belts to be dispensed with and a quicker reverse to be obtained. In a modified form it is used as a magnetic clutch for holding articles to be ground or turned, as a holder for portable drills, &c.; these and other applications are, and have been for some time past, in successful operation.



Details of Drake & Gorham Magnetic Clutch.

Messrs. Electric Control, Ltd.

This Glasgow firm manufactures direct-current automatic starters of the one-solenoid no-sliding contact type. This apparatus has been installed to control lifts, hoists, motor-driven pumps, air compressors and hydraulic accumulators, where, on account of the extreme intermittency of operation, the sliding finger contacts very soon become burned. All such trouble is avoided in this automatic starter, as only copper-to-carbon normal contacts are used. Starters of this type are made from 1 H.P. to 150 H.P.

The automatic starter made by this company for operation on alternating-current circuits constitutes a novelty in starting gear. The magnets are energised from the A.C. lines; a unique combination of a sliding plunger and a switch toggle prevents all noisy and vibratory forces, which have hitherto prevented the adoption of A.C. magnets for this work. Copper-to-carbon normal contacts are used in these A.C. starters also, the sliding finger type being avoided. A three-phase reversing controller, which illustrates the nature of this starter, is shown herewith. The reversing switches exciting the stator are on the upper panel, and the rotor switches cutting out the resistance steps are below.

All accessory apparatus, such as pressure regulators, float, tappet and pedal switches, are supplied to operate in conjunction with these automatic starters.

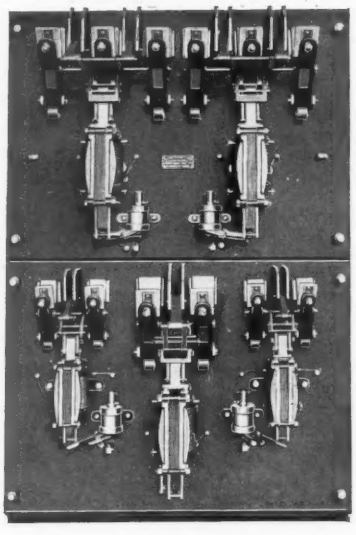
The sole rights of manufacture in Great Britain of both the D.C. and the A.C. starters described above are held by Electric Control, Ltd, who make the complete apparatus at their Glasgow works.

Fluxite Soldering Paste.

The Auto-Controller and Switch Co., Bermondsey, are the sole makers of this soldering paste, which we, in common with others, have found highly efficient and convenient; besides copper, brass, &c., it works well with iron and lead, and has the advantage of cleanliness.

Messrs. Cowans, Ltd.

Messrs. Cowans, Ltd., have brought out a new D.P. enclosed type circuit-breaker, which, as shown in the illustration, is specially designed for use in connection with motors, as it is provided with no-volt release in addition to overload trip. The firm have already supplied some of these new circuit-breakers to Admiralty requirements, for use in connection with crane work in dockyards. The design is generally similar to that of their standard circuit-breakers for small currents, which they make both of the open and enclosed type. The circuit-breaker is closed through a very simple toggle action, and is held in the closed position by the armature of the no-volt coil. When the voltage fails the armature drops and the circuit-breaker is released. These circuit-breakers embody the free-operation handle action, so that they cannot be held in a closed position on a short circuit, and they are also fitted with magnetic blow-out. A time-limit attachment can be added to the overload trip if desired, and this is always done in connection with Admiralty work, as a time limit attachment is specified.



Electric Control, Ltd, A.C. Automatic Starter.

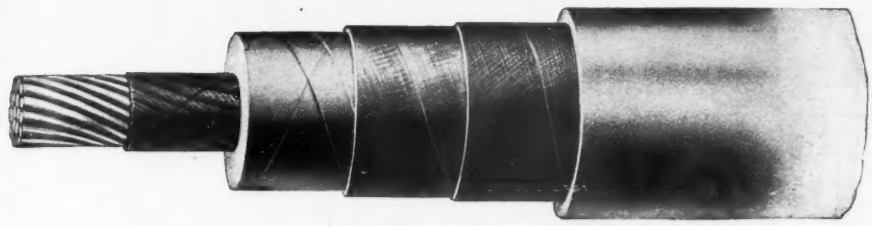
Cowans, Ltd., D.P. Enclosed Circuit-Breaker.

The British Insulated and Helsby Cables, Ltd.

Amongst other specialities introduced by this firm for use in works, shipyards, collieries, &c., is a flexible protection for use on trailing cables, for coupling-up portable apparatus, &c.; this is the "Helsby" hard-cord braid, and consists of specially prepared tough hemp cords, impregnated with a durable weatherproof compound. Combining perfect flexibility with resistance to abrasion, this forms an excellent covering for cables that undergo much handling and rough usage, and it can be applied to any cable at moderate cost.

Helsby "ozone-proof" cable is another useful product. Ozone is rapidly fatal to vulcanised rubber, which is so generally used for the insulation of high-pressure cables on switchboards, &c., and as ozone is liable to be formed in such situations, many failures have occurred which were in all probability due to this cause. The B.I. and H. Co., while still using vulcanised rubber, protect it both internally and externally with a layer of a special dielectric which is unaffected by ozone, air, and copper salts. The diameter and weight of the cable are practically the same as in the case of ordinary V.R. cables for the same pressure.

B.I. & H. Cable Protected with "Helsby" Hard-Cord Braid.



B.I. & H. Ozone-Proof Cable.

The Electrical Apparatus Co., Ltd.

To secure the full benefit of the electric drive, the advantages which it offers in respect of speed regulation should be utilised whenever this is possible. With this object in view, the Electrical Apparatus Co. have developed a series of combined starters and regulators for D.C. motors, for either series or shunt regulation. The former method is necessarily the less economical, but in some instances is nevertheless the preferable; but in general the shunt method is the best, and we illustrate the E.A.C. combined starter constructed on this system. There are two moving arms, one—the leading arm—being controlled by a strong spring at the hub, which tends to throw it back to the "off" position, while the main lever, which carries the handle, is free. In starting, the latter is moved slowly over the contacts, pushing the auxiliary lever before it, and starting the motor. If the handle is released during this operation, the auxiliary lever is thrown back by the spring, carrying the main lever with it, and putting all the starting resistance in circuit; but if the levers are pushed up to the full "on" position, the auxiliary lever is held there by the no-voltage magnet as shown, and the main lever can then be moved back to regulate the speed by inserting resistance in the shunt of the motor. The shunt field is at full strength during the starting period, and the series starting resistance is, of course, cut out when regulating on the shunt. Failure of the supply allows the auxiliary lever to fly off, carrying the main lever with it. An overload trip can also be provided.

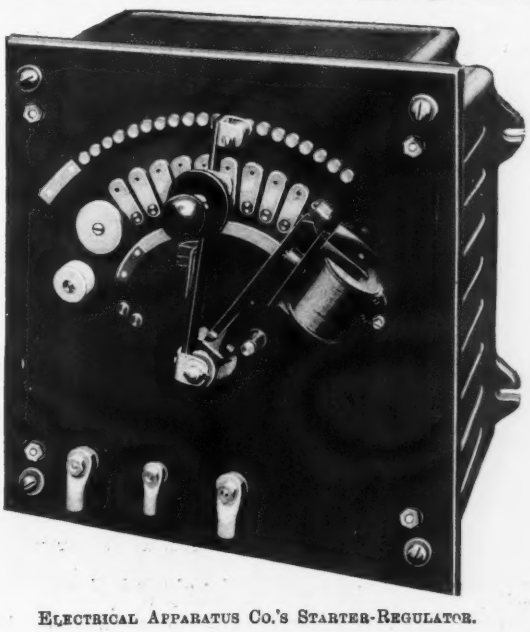
The series starter-regulator is of similar design, but of course has no shunt-resistance contacts.

Messrs. Clarke, Chapman & Co., Ltd.

The accompanying illustration shows a portable winch which Messrs. Clarke, Chapman have recently built for shipyard work. It is carried upon a truck provided with four wheels, the front pair being mounted on a swivelling frame, to which a pair of shafts are attached. A platform for the driver and operator of the winch is provided, in front of which are fitted a tramway-type controller and three-pole switch and fuses with ammeter, all connected up ready for the three incoming portable cables to be connected.

The winch is provided with two speeds, obtained by means of two pair of spur gear between the drum shaft and the next motion shaft, the pinions being loose and driven by claw clutches operated by one lever, so that both clutches cannot possibly be in gear at once. Part of this lever can be seen in a vertical position behind the controller. A foot lever is provided, operating a band brake on the drum and a small post brake on the motor pinion.

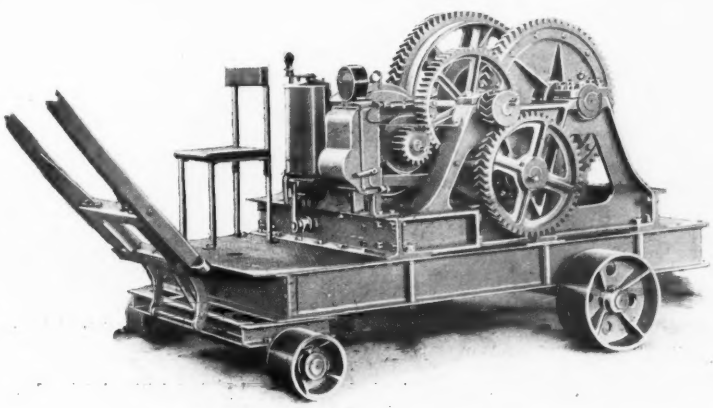
The duty of the winch is to lift 6 tons at 25 ft. per minute, or 3 tons at 50 ft. per minute. It can, of course, be provided with warping drums when required. Gear-guards are fitted over all gears, but were removed for the purpose of taking the photograph.



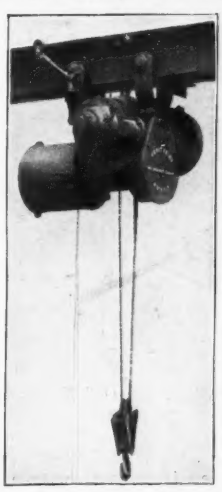
Electrical Apparatus Co.'s Starter-Regulator.

Messrs. Veritys, Ltd.

A very neat and handy run-way traveller has been introduced by Messrs. Veritys, Ltd., for use in works, warehouses, &c. The

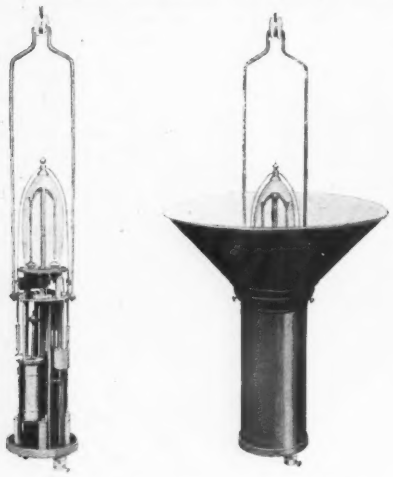


Clarke, Chapman's Portable Electric Winch.



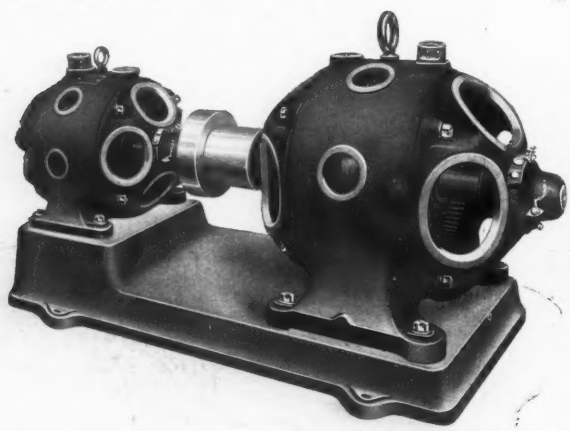
Veritys' Electric Run-way.

accompanying figure shows very well the leading features of the design. The standard size of run-way gear is capable of lifting 20 cwt. at 15 ft. per minute; it is provided with a magnetic brake, and automatic over-winding and under-winding devices. A special advantage of the design is the low overall height, enabling it to be used in shops having comparatively low ceilings. The convenience of a power-operated traveller of this kind, which has a wide range of utility, hardly needs demonstration.

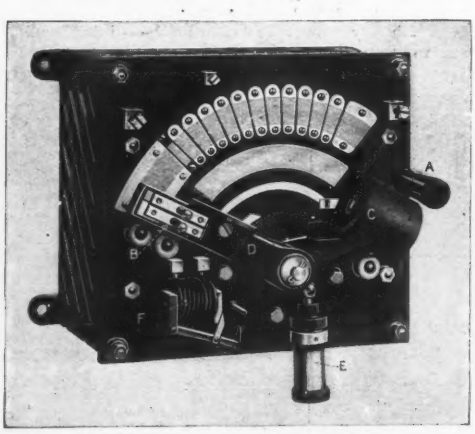


Veritys' "Aston-Worsley" Enclosed Inverted Arc Lamp.

Other illustrations show a new design of the "Aston-Worsley" arc lamp, of the inverted type for indirect illumination; this is believed to be the only enclosed inverted arc lamp on the market, and has the advantage that there is practically no obstruction between the arc and the ceiling from which the light is reflected.



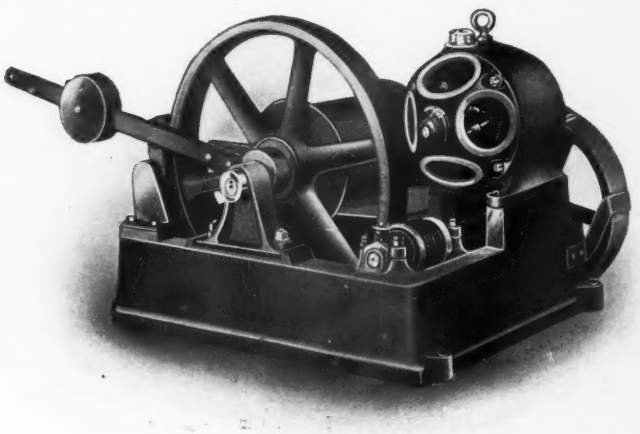
Rhodes R.Q. Patent Combination System.



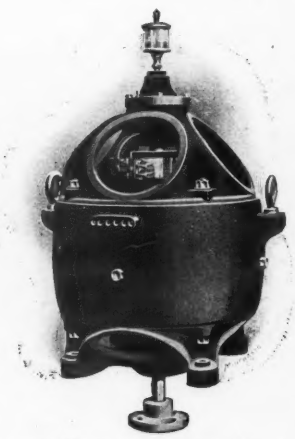
E.O.A. "Autograd" Motor Self-Starter.

Messrs. Rhodes Motors, Ltd.

A complete series of electrically-driven winches is made by this company, arranged for friction or gear drive, and suitable for use in building operations (an outlet for electricity supply that has not been adequately exploited), mines, quarries, &c. One of these is illustrated above; it is provided with friction drive, and the motor runs continuously while the winch is in use, the power being applied by moving a lever, which brings the large friction wheel into contact with the pressed-paper pulley on the intermediate shaft. The motor is well protected against falling bricks, &c., and may be either D.C. or A.C.

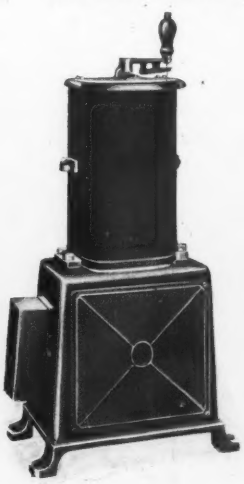


Rhodes Electrically-driven Winch.



Rhodes Vertical-Spindle Motor.

To start their large single-phase induction motors with squirrel-



New E.O.A. Motor Controller.

E.O.A. Vertical Motor.

Electric & Ordnance Apparatus.

cage rotors, without taking an excessive current, Messrs. Rhodes Motors, Ltd., have adopted the use of a small starting motor, connected with the main motor through an automatic coupling, which disengages when the main motor comes into action. By this means the motor can be started on a torque of one-third to one-half the full-load torque, while taking only half the full-load current, and using only a simple starting switch. The combination (known as the R.Q. type) is illustrated opposite, and is made in sizes from 20 to 100 h.p. The system also conduces to economy, which becomes very appreciable if the motor is started frequently. The auxiliary motor is of the company's repulsion type.

Another figure shows a vertical-spindle motor made by the company for use in driving pumps, drills, &c., for which there is a considerable demand. This type is provided with a special ball-thrust bearing to suit the conditions of running. It may be either d.c. or a.c.

The Electric and Ordnance Accessories Co., Ltd.

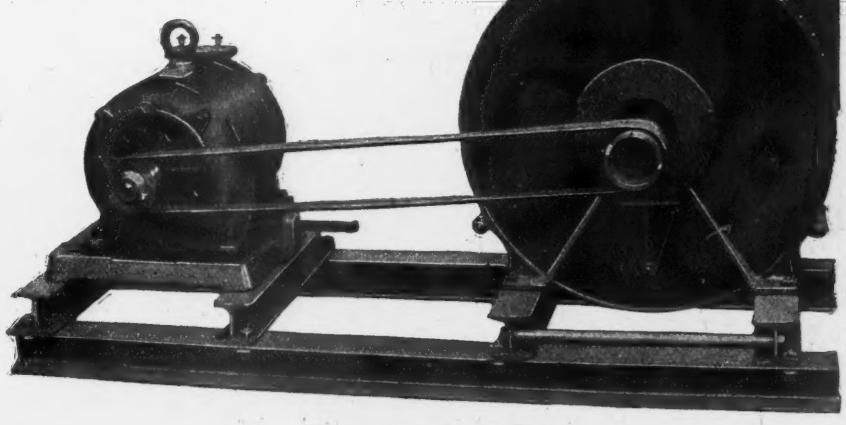
A variety of apparatus suitable for use in works is made by this company. One of our illustrations on p. 790 shows their "Autograd" self-starter for electric motors, the operation of which is independent of the user's judgment, or carelessness. To start the motor, the handle A, carrying a small pot magnet C, is pushed over to the lever B; as soon as it reaches it the armature D holds it, and forms a grip between the handle and the lever. Behind the slate is a flat steel spring, which then draws the switch-arm over the contact plates. The dashpot E, connected to the handle A, checks the forward motion of the lever, so that the motor cannot start up too rapidly. The overload device F operates both when the switch is in the full-on position and during the action of switching on; should an overload occur, the pot magnet C at once becomes de-energised, causing the lever B to fly back to the position shown in the figure, while the handle A will continue to move slowly forward until it reaches its first position. The controlling action of the dashpot renders it impossible to accelerate the switch so rapidly as to cause damage to the motor, and makes this starter practically fool-proof. This and other patterns of starters are made also in a waterproof type.

A new controller, specially designed for use on cranes, with small machine tools, and in other shop positions, is shown on p. 790; the resistance is enclosed in a cast-iron pedestal, on the top of which the controller is mounted. This is a compact and well-protected arrangement, and has the advantage that the only connections to be made *in situ* are to the mains and the motor.

A neat little vertical motor is shown in the remaining figure, suitable for machines which employ vertical spindles, such as bottle-washing machines, &c. Arc lamps of various types, fans, telephones, switchgear, &c., are also amongst the company's products; a special design of arc lamp is made for the illumination of the hold of a ship when loading or unloading, the reflector being so shaped as to illuminate a circular area 20 ft. in diameter at a distance of 15 ft.

Messrs. Adnil Electric Co., Ltd.

Messrs. Ingram & Co., organ builders, Hereford, who are erecting a large organ at the Japan-British Exhibition, in the Palace of Music, have placed the order for the complete organ-blowing equipment with the Adnil Electric Co., Ltd. The installation consists of a silent patent Discus blower, capable of delivering 750 cb. ft. of air at 6 in. water gauge from one outlet, and 450 cb. ft. of air at 12 in. water gauge from the second outlet, the blower being driven by a three-phase induction motor with short-circuited rotor, supplied at 380 volts. A special feature in connection with this motor is the automatic starting switch, controlled from the keyboard. This consists of a three-pole double-break main switch, with renewable sparking contacts, controlled by two solenoids. These solenoids are operated by a two-way pilot switch fixed in a convenient position on the keyboard, and arranged so that when the pilot switch is moved in one direction the top solenoid is energised, thus closing the switch, and when the pilot switch is moved in the other direction, the bottom solenoid is energised, opening the switch with free, positive, and quick-break action.



Adnil Electrically-Driven Blower.

In connection with the solenoids there is an automatic switch which cuts out the solenoids immediately the switch has been operated in either one direction or the other, so that neither of the solenoids is absorbing energy when the switch is either in the "on" or "off" position. The consumption of energy is extremely small, being about 100 watt-seconds, when cutting either in or out. The action is rapid, and consequently there is no burning of the contacts. The illustration shows a similar blower with a d.c. motor, suitable for any purpose requiring air-blast at moderate pressures.

Messrs. W. G. Walker & Co.

The fan brake invented by Mr. W. G. Walker, and described some years ago in our pages, has attained a remarkable degree of success, being now made for outputs up to no less than 150 h.p., at speeds from 250 to 3,000 r.p.m. The two vanes employed for the 60-h.p. size are only 17 × 8½ in., and run at 1,020 r.p.m. for the consumption stated. As each brake is calibrated for 15 positions of the vanes on the arms, and several sets of vanes are supplied with each brake, a single apparatus covers a very wide range of utility; the 30 and 60-h.p. sizes, for instance, measuring 45 different outputs at each speed. The 6-h.p. size has blades 6 in. square, and only occupies a length of 1 in. on the shaft. Nothing could be simpler than the device or its mode of application, the horse-power being determined either from a chart supplied with the instrument, or by multiplying the cube of the speed by a constant.

Messrs. Reavell & Co., Ltd.

This well-known Ipswich firm has for some years specialised in air-compressor plants with considerable success. These are made in a variety of sizes and types for almost every class of duty, and have frequently figured in our pages.

One of the handiest, and at the same time, smallest machines, turned out by the firm is composed of an "Axial" compressor direct-coupled to an electric motor of either the alternating or direct-current type. This apparatus has been previously referred to by us, but its great utility for cleaning purposes wherever electrical apparatus is employed in quantity justifies some further description.

The compressor portion consists merely of a double-ended piston, in which is a small slipper, actuated by a crankpin turned out of the compressor crankshaft, from which it receives a reciprocating motion. The compressor is bolted to the motor carcass, which is provided with handles or mounted on rubber-tired wheels, thus rendering the set easily portable.

A small pressure gauge is fitted; a starting switch, 30 ft. of flexible and a wall plug are provided for the motor, and 15 ft. of hose and a nozzle for the air blast. Both the flexible and the hose are coiled neatly on a drum fitted on the motor carcass. The normal working pressure is 20 lb. per sq. in., and the cubical dimensions of the machine are 2 ft. × 1 ft. 9 in. × 1 ft. 8 in. For larger quantities of air at 30 lb. per sq. in. a somewhat larger duplex compressor, gear-driven by an electric motor and mounted on three rubber-tired wheels, is supplied.

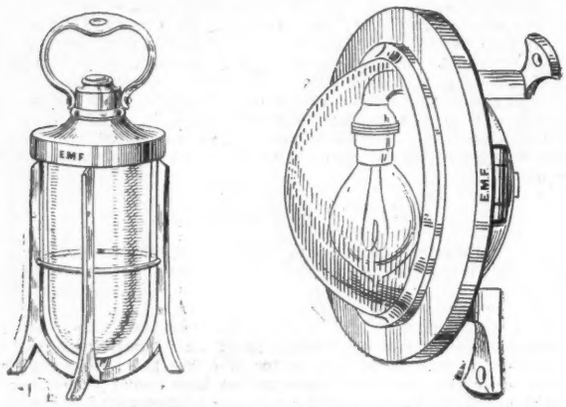
Messrs. Reavell are also specialising in quadruplex compressors direct coupled to oil engines, and these also can be arranged for mounting on wheels, so as to facilitate movement in the case of supplying pneumatic tools in shipyards or bridge building operations. Being self-contained, a set of this type is well adapted for prospecting work.

The E.M.F. Ltd.

The E.M.F. Ltd. are supplying the combination which we illustrate on p. 792 for use on steamships and railway trains, and for general use in hot climates. It consists of an electric fan, a fork and trunnion piece, and a special back plate, while a combined regulator and switch can be used when desired.

By means of the special back plate, which has a bayonet locking arrangement and separate electrical contact, the fan with its fork and trunnion piece can be inserted or detached at will. With the aid of the large milled nut, the fan can, on insertion, be quickly clamped into position, and by a turn of a fly-nut be made to face in any direction desired, whilst universal movement can be obtained by adjust

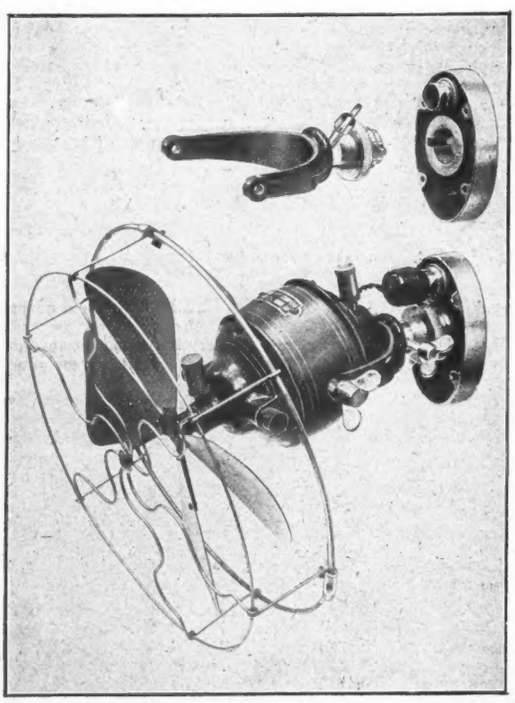
ment of the trunnion. The electrical contact illustrated is only one of various forms which can be supplied. The one shown has the advantage of permitting the use of the motor (when temporarily or otherwise required) at a distance. This is effected by the use of a longer flexible cord, using the back plate as terminal. The fan can be supplied in any voltage suitable for the purpose required.



E.M.F. Portable and Bulkhead Lamps.

For use on trains and where tampering is feared the combination can be supplied with a special locking arrangement and separate key.

The E.M.F. Ltd. are specialists in ship fittings, their manufactures being in use in many shipbuilding yards in this country, and in foreign yards as well. Altogether the firm have about 200 patterns of the ordinary recognised types, and many up-to-date designs. The works are situated in the Midlands, the centre of the metal trade, where they have every means of coping with an extensive business. They have a staff of experienced draughtsmen available for making up customers' own special designs, and patterns are worked



E.M.F. Fan Combination.

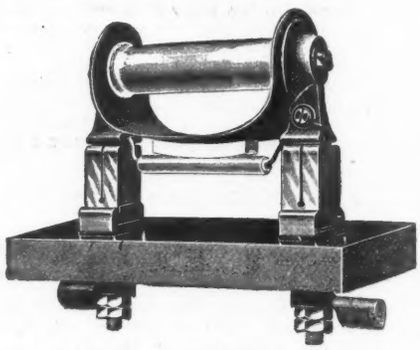
up on any rough ideas that may be imported. Fittings in all the recognised metals for ships, iron, brass, white metal, and in all usual finishes, polished and lacquered brass, black bronze, oxidised silver, silver plate, mercurial gilt, &c., are supplied. We have before us a catalogue of some new and original designs, which the firm have got out for passenger vessels, one or two of which we select for illustration.

Copies of these catalogues and designs may be obtained on application to the head office of the firm at 10, Ironmonger Lane, London, E.C.

Messrs. Ward & Goldstone.

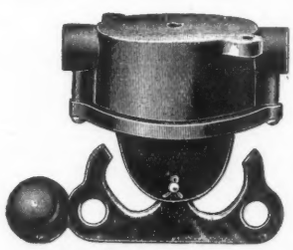
The "Guardian" hand-lamp, brought out by this firm to comply with the Home Office regulations without the necessity of employing an earth-wire, has been improved since its introduction, and is now, it is claimed, perfectly safe to the user, while it is exceptionally strong and able to withstand rough usage.

Another accessory designed to secure the safety of the person is the "Guardian" hand-shield fuse, which is illustrated herewith. In this fuse, the wire, instead of passing through the handle, is carried through a tube of asbestos or other material below a hand-protecting shield. This design has been very widely adopted, as



"Guardian" Hand-Shield Fuse.

it removes the danger to which the operator is exposed when the wire is carried through the porcelain handle, which may be shattered on a heavy short occurring, with serious consequences to the hand of the user.



Rope-controlled Switch.

The other figure shows a simple switch for rope control; the advantage of this is that it is unnecessary to bring the wiring down the wall to a switch in order to control lamps or small motors. The switch is fixed near the ceiling, and is actuated by a cord. It has recently been adopted by Government departments, and has been largely used in engineering works.

Messrs. Siemens Bros. & Co., Ltd.

Messrs. Siemens Bros. have for some time made a special feature of their "O.S." wiring system, which possesses marked advantages, not only for ordinary use, but also for wiring in works, on the concentric system, the outer conductor being everywhere at earth potential. Earlier systems of concentric wiring required special and expensive fittings, but in the "O.S." system the cost is reduced to a minimum, as special fittings and jointing devices are not required; standard accessories can be employed, the wiring can be erected rapidly and cheaply, and the electrical conductance and continuity can be relied upon. Where "Kalkos" conduit is used as an earthed return conductor, only half the amount of wire need be employed, and, therefore, very small conduits can be used, compared with a two-wire insulated system. If "Stannos" wires are used, with the sheathing as an earthed return, the drop in volts is less than that due to two wires of the same size as the inner conductor, owing to the greater section of the sheathing, and thus smaller wires may be employed, effecting a saving of about 50 per cent. in material. All in all, Messrs. Siemens claim a total saving of 40 per cent. for the "O.S." system, in materials and labour.

In a supplementary catalogue, just issued (No. A517), Messrs. Siemens Bros. explain these and other advantages of their "O.S." system of concentric wiring, and describe the double-wound transformers, tantalum lamps, "Stannos" wires (now made in six sizes) and a new "Stannos" house fuse-box for concentric wiring, besides giving general instructions for carrying out the system.

Messrs. Musgrave & Co., Ltd.

A special feature of Messrs. Musgrave's work is the "Ulster" fan, which has been largely applied to two chief purposes—the production of mechanical draught and the collection of dust. For the former purpose the fan may be driven by belt or engine, but there is no machine so well adapted to this end as the electric motor, and the firm have installed many of their fans coupled to such. The collection of dust, &c., by fan-draught is a speciality of the firm, who have also elaborated a system for the washing, purifying and heating of air for the ventilation of public buildings. The removal of the dust evolved in manufacturing operations is an important function, not only on account of the employés, but also in many cases because the dust is of value, and an efficient system of dealing with it is often well worth the cost of its installation.

Messrs. Musgrave also make the "Stanwork" high-speed engine, which is suitable for coupling to dynamos, and is made in a variety of sizes.

NOTES.

(*Continued from page* 782.)

Institution and Lecture Notes.—Arc Works Engineering Society.—The annual general meeting and conversazione of this Society was held at the Arc Works Club House, Chelmsford, on Friday, April 29th. The report for the past session showed that the Society was in a thoroughly satisfactory condition. Eighteen meetings had been held during the session, at which papers covering a wide range of subjects were given by members and friends. The Society offers premiums for papers read at its meetings by pupils and apprentices at the works. The first-class pupils' premium was won by Mr. C. G. S. Willet for his paper on "The Use of Electricity for Lighting and Cooking." Mr. F. Jackson and Mr. W. Peyton were bracketed for the First-Class Apprentices' Premium, their papers being on "Metal-Cutting Tools," and "Metal Founding," respectively. The annual general meeting was followed immediately by a conversazione, which was presided over by Col. Crompton. After a short musical programme in which the following gentlemen took part:—Messrs. A. F. Bearsby, A. Burn Callender, E. S. Shoults and W. G. Smith, an interesting exhibition of sleight-of-hand was given by Mr. J. B. Knight. During the interval there was an exhibition of models, among which were to be seen various types of aeroplanes. In addition to the scale models, a full-size aeroplane, constructed by two members of the Society, was on exhibition. After the interval, Col. Crompton presented the premiums to the successful competitors. The rest of the evening was devoted to aviation. The general principles underlying the construction of aeroplanes and flight in general were dealt with in a short paper by Mr. Crompton, which was illustrated by some interesting and most successful experiments. The paper was followed by a cinematograph exhibition, showing pictures of actual flights.

Lord Rayleigh, who was present during the greater part of the evening, was introduced to the meeting by Col. Crompton, and in reply, he spoke in appreciation of the enterprising spirit that had become associated with the Society. He further expressed the pleasure he had in being present and listening to Mr. Crompton's interesting lecture.

Institute of Metals.—The annual autumn meeting will be held in Glasgow on September 21st and 22nd; papers of scientific and practical interest will be read, and visits made to works of metallurgical interest.

There has been established at the offices of the Institute a Pathological Museum for specimens of metals and alloys. This museum, which is the only one of its kind, ought to be of great service to all interested in the metallurgy of the non-ferrous metals, as it is intended that it shall contain specimens showing the various ways in which such metals as copper, brass, aluminium, &c., can fail, as a result either of faulty manufacture or of improper usage.

Institution of Electrical Engineers.—On account of the death of His Majesty King Edward VII, there was no meeting of the Institution yesterday.

Institution of Electrical Engineers (Glasgow Local Section).—The tenth annual report of the Local Section Council was submitted to the general meeting of the Section on Tuesday last. The membership shows a substantial increase on last year's figures, being 304 as compared with 290 The Office Bearers and Committee for the Session 1910-11 will be as follows: — Past chairmen, Francis G. Bailey, W. W. Lackie, E. George Tidd; chairman, Sam. Mavor; vice-chairman, J. A. Robertson; chairman of Students' Section, Henry A. Mavor; hon. secretary and treasurer, James E. Sayers; ordinary members of Committee, Robert Robertson, Magnus Maclean, William M'Whirter, J. Campbell Macmillan, W. C. Martin, J. T. Bottomley, T. B. Murray, T. C. Parsons, John Ferguson.

The fourth annual report of the Glasgow Students' Section shows that good progress has been made. The chairman for next Session is Mr. H. A. Mavor, and Mr. E. V. Buchanan is the hon. sec.

Electrical Fatalities.—In the Hamilton Sheriff Court on Thursday, 4th inst., an inquiry was held into the circumstances attending the death of Alexander Hinshelwood, electrical engineer, of Wishaw, who was killed while following his employment in the Glasgow Iron and Steel Works, Netherton, Wishaw. John Hill, the foreman electrician at the works, stated that on Saturday, April 2nd, the deceased and he were executing some repairs to an overhead electric charger. For the purpose of making some tests to ascertain what was wrong he (Hill) went to the top of the charger and instructed his assistant, when he got the necessary signal, to pull out the switch and replace the fuse. This was done twice perfectly correctly, but when the signal was given the third time the accident happened. Hinshelwood gave a cry, and on getting to the top of the charger witness found that the young man had sustained an electric shock which, unfortunately, had fatal results. On examination it was found that Hinshelwood had failed, on the third occasion, to pull out the switch. So far as one could see death would be instantaneous, for the pressure would be 320 volts. The deceased was a careful electrician, and had been employed at the works for four years. Similar evidence was given by James A. Brown, electrician, Wishaw, and Hugh Sproul, engineer, Wishaw. A formal verdict was returned by the jury, who expressed sympathy with the relatives of the deceased.

It is stated that Mr. G. J. Porter, superintendent of the Brush Electrical Engineering Co.'s works at Loughboro', was killed by electric shock on Saturday. He was engaged in the testing department when he received a 2,000-volt shock.

Electrical Imports and Exports in April.—The trade returns for April show an increase of £8,170 in electrical goods imported and an advance of £54,258 in electrical exports, as compared with the corresponding month of 1909. The increase in exports for the four months of 1910 is £741,770. The total figures for all branches of trade, &c., show, for the same period, increases of 9·55 per cent. in imports, 15·70 per cent. in exports, and 23·3 per cent. in re-exports. The total increase in value of exports for the four months is nearly 18½ millions sterling.

In his speech to the shareholders of the British Westinghouse Electric and Manufacturing Co., the chairman made special reference to the continued expansion of electrical exports, and the necessity for paying special attention to this branch of trade when there was a manufacturing capacity available in excess of the home demand.

South African Appointments.—It may be remembered that some years ago the Newcastle-upon-Tyne Electric Supply Co. inaugurated an "improver" system, under which men who have just finished their apprenticeship are able, as junior assistants, to gain experience of large power supply work in the generating stations, sub-stations, and the extensive transmission and distribution systems throughout the area of this company and the other power companies with which it is associated. Last week, by arrangement with the Newcastle Co., a considerable number of these assistant engineers sailed for South Africa, to take up important positions on the staff of the Victoria Falls and Transvaal Power Co., whose chief engineer, Mr. Bernard Price, also came from the North of England. He was, in fact, for several years closely connected with the extension of the Newcastle Co.'s system.

Fire.—It is reported that considerable damage was done by a fire on 10th inst. on the premises of the Foxcroft & Duncan Engineering Co., Ltd., at Hackney.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Newcastle-under-Lyme T.C. on May 4th confirmed the appointment of Mr. A. J. C. de Renzi as electrical engineer.

The Warrington T.C. has increased the salary of Mr. F. V. L. Mathias, chief electrical engineer, from £350 to £400 per annum.

Mr. Victor A. H. McCowen having, as announced last week, resigned his position, the Salford Electricity Committee recommended the amendment of the scale of salaries adopted three years ago, in so far as it related to the remuneration of the borough electrical engineer. The scale fixed the minimum salary at £800, rising to £1,000. The Committee recommended the fixing of a minimum salary of £500, rising by an advance of £50 every two years to £700. The Council accepted the recommendation at a meeting on the 4th inst.

At the St. Helens T.C. on the 4th inst. Ald. Beecham moved that the salary of the electrical engineer, Mr. E. M. Hollingsworth, be increased from £400 to £450, and by two subsequent instalments to £500. He said that by Mr. Hollingsworth acting as consulting engineer, he had saved them at least £2,500 in fees. The resolution was carried.

Mr. C. W. Rycroft having received another appointment, has resigned his position of draughtsman in the Battersea Electricity Department, and a temporary successor is to be advertised for.

As a result of a rearrangement of the electricity staff, the Stockport T.C. has appointed Mr. G. C. Wood as motor superintendent, at a salary of £150 per annum; Mr. H. H. Jowers, as mains and services superintendent, at £150; Mr. R. H. Lee, as resident engineer, at £150; and Mr. H. Abson, as commercial assistant, at £114 8s.

Mr. C. Holman has resigned his position as assistant engineer to the Surbiton Electricity Supply, having been appointed resident engineer and manager to the Lymington Electric Light and Power Co., Ltd.

General.—Mr. Lester Betts, who has been for some time connected with the export department of the British Westinghouse Co., has been appointed manager of the export department of Messrs. Baxter & Caunter, of Charing Cross Road.

Messrs. Morgan I. M. Williams and Harold W. Couzens (Morgan Williams & Couzens, consulting engineers, 39, Victoria Street, Westminster) have dissolved partnership. Mr. Couzens will attend to debts and continue the business under the old name and at the same address. Mr. Morgan Williams is retiring after being in practice for 20 years.

Sir George S. Gibb is shortly to retire from the position of managing director of the Underground Electric Railways Co., he having been appointed chairman of the Road Board under the Development Act.

Mr. G. Basil Barham, A.M.I.E.E., desires our readers to know that he is not the gentleman of the same name who has joined the board of Messrs. Hill & Harrington, Ltd.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Vera Cruz Electric Light, Power and Traction, Ltd. (89,686).—Trust-deed dated March 11th, 1910, to secure £300,000 5 per cent. first mortgage debentures to bearer. Property charged: Existing concessions, lands and immovable property in Mexico, and the company's undertaking and property, present and future, including uncalled capital. Trustees: Rt. Hon. Lord Knollys, G.C.B., G.C.V.O., Buckingham Palace, S.W., and C. G. Hyde, 4, Pump Court, Temple, E.C.

Electric Supply Corporation, Ltd. (52,036).—Trust deed, dated July 18th, 1904, stamped to cover a further £25,000 on April 21st, 1910, in addition to £130,000 already registered. Property charged: all the company's assets. Trustees: C. F. Tufnell, Kenley, Surrey; and W. B. M. Bird, 58, Cadogan Place, S.W.

Ackroyd & Best, Ltd. (54,600).—Issue on April 14th, of £1,450 debentures, part of a series of which particulars have already been filed.

F. E. Baker, Ltd.—Particulars of £7,000 debentures, created April 15th, 1910, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £3,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. J. Annan Bryce, M.P. (chairman), presided on Monday at Hamilton House, E.C., over the tenth annual general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 748), he said that although they showed a loss on last year's working of £798, yet this had to be compared with a loss of £6,521 for the year ending December, 1908. Therefore, this year's accounts showed a distinct improvement, more especially as the difference between the two figures he had quoted was not the full measure of the improvement. In the 1908 accounts the loss of £6,521 was arrived at after deducting a profit of £11,341 brought forward from the 1907 account, so that the actual loss in 1908 was £17,862, and this year there was an improvement of over £17,000. The result was even a little better than this, because the accounts for 1909 had had to bear the full service of the prior lien debentures amounting to £20,000, whereas in 1908 the interest and sinking fund were in operation for only a portion of the year and amounted only to £12,525. Turning to the balance-sheet the capital authorised and subscribed remained the same. The 6 per cent. prior lien debentures had been reduced by a further £5,700 by the purchase of 57 debentures in accordance with the terms of the trust deed. The cancellation of these debentures, together with those acquired last year, made altogether 107 debentures redeemed at a cost of £10,262. The 4 per cent. mortgage debenture stock remained as before for sundry creditors and credit balances, which was £170,847, showed a considerable increase as compared with 1908. This, however, was largely due to a special circumstance. The amount of unpaid accounts due on December 31st last was, as a matter of fact, within about £1,000 of that of 1908, and the difference was accounted for by the fact that in connection with a large contract of about £150,000, they had placed a large part of the materials with sub-contractors. The terms of the direct contract were the payment of 50 per cent. at shipment and the balance at stated intervals. They made the same terms of payment with their sub-contractors, so that whilst they were credited with the full value on their invoice at the time of shipment they were only paid 50 per cent. The next item was the reserve for employers' liability, and the directors believed the amount reserved was about 100 per cent. to the good. They did this insurance themselves, and found it a much cheaper method than going to one of the offices, and they were providing a good reserve against the possibility of loss. On the credit side of the balance-sheet the item of patents and goodwill remained the same. The buildings and machinery at Trafford Park had been credited with £10,262 as general depreciation, being the amount expended on the reduction of the prior lien debentures, and the item of machinery and plant had been credited separately with depreciation amounting to £6,480, after having been increased by a further expenditure of £9,730, so that there was a net increase in this item of £3,250. Stock and material in hand, and in process of manufacture, £429,339, showed a small increase over last year, and this was, of course, an item which fluctuated more or less according to the state of business. It was the aim of the directors to keep it as low as possible compatible with the proper carrying on of the business. Completed work on contracts, &c., amounted to £393,249, and sundry debtors to £136,226, or a total of £529,475. Taking those items together, and comparing it with sundry creditors on the other side, it would be seen that the amount due to the company was three times as much as they owed, and they were also £44,279 in excess of the corresponding items in last year's accounts. There was a small increase in the item of shares and debentures in other companies, but that was accompanied by a reduction in contingent liability. The item of £288,542 was the actual cost. Of this £200,000 was in the Clyde Valley Power Co., £50,000 in the Traction and Power Securities Co. and £30,000 in Mersey Railway 4 per cent. stock. The last security had considerably improved in value. The Clyde Valley Co. had turned the corner and was beginning to make profits, so that the directors had every reason to hope that the value placed upon this security would eventually be realised. They were all aware that these power schemes took a long time to develop, and it was only after years that they became profitable; of course, the object of the company in going into them was to secure a large order for their works, and he was glad to say it looked like fully justifying itself. The Traction Co. shares had also improved somewhat this year. The bills receivable were somewhat larger than in former years because they did not discount them whilst they had so large a cash balance at the bankers. The cash at bankers and in hand was £120,000, and if present indications bore out their promise, the company would have need of capital in the near future for increased business. The auditors mentioned that no provision had been made for claims under a certain contract. This referred to a matter of long standing which had gone to arbitration. The arbitrator was now considering his decision which they hoped would be in their favour. With regard to the profit and loss account, £20,000 a year was needed for interest and redemption of the prior lien bonds, and as the bonds were redeemed the amount available for redemption each year would increase. The item of expenses on surplus land and buildings showed a slight increase which arose from the fact that last year the steel foundry had only been shut down for nine months, whereas this year the whole 12 months had been taken into account. The main expense, however, was in respect of the surplus land not required for the works. The Trafford Park Estate was gradually developing, and they hoped for a realisation at no very distant date of the two plots of land now lying idle. Turning to the credit side, it was satisfactory to note that whilst there had been a diminution in the volume of business yet it had been accompanied by an increase of profit; this being due to economies effected in working and to increased efficiency in manufacture. With regard to the business generally, he was glad to be able to say that notwithstanding a most unpropitious year, the falling-off in orders as compared with 1908, was only about 6½ per cent. It was satisfactory to observe that the export business continued to expand, and no means were being neglected to extend this side of their operations, especially in the British Possessions. They continued their friendly relations with the foreign Westinghouse companies, and had been doing a fair amount of business abroad. It seemed hardly necessary to dilate on the condition of the electrical trade, which had been so often referred to. Competition had continued to be as severe as ever, and manifestly if there was only enough business to partially fill the works of manufacturing companies, it must inevitably result in the cutting of prices. They themselves were specially handicapped by having works much too large for the amount of business done. They could only wait for a revival of trade, and the natural growth of the electrical business, and endeavour meanwhile to foster economy in all branches of the business. He thought that this year there were distinct signs of an improvement in the volume of business.

Mr. H. W. Birk asked what contract was referred to by the auditor.

The Chairman said the company had a large claim under a contract, whilst there was a larger counterclaim against them. The company's claim was £82,000. It was a most complicated matter, and the arbitration had taken a long time, but he did not think it would be an advantage to go into details at that moment.

Mr. Newcomb Carlton (managing director) seconded the motion, and the report was adopted.

Replying to the resolution re-electing him a member of the board, the Chairman said the credit of bringing the company into a better position was entirely due to the managing director, Mr. Carlton. Anyone who knew the struggle of the last four years would give Mr. Carlton the credit. His share of any credit had been only in sticking to the company and backing Mr. Carlton up.

On the motion of the Chairman, Mr. P. A. Lange (managing director of works) was elected to a seat on the board.

Mr. Birk, in moving a vote of thanks to the board and the staff, referred to the feeling of irritation he had had in the past against the early directors of the company, and congratulated the board on having at last turned the corner.

The Chairman, in reply, said they must not be too sanguine about dividends for they had a lot of leeway to make up, and he would like to see the items of patents and goodwill reduced.

Callender's Cable and Construction Co., Ltd.

The directors, in their statement for the year ending December 31st, 1909, show a balance at the credit of profit and loss account for the year's working of £54,362, plus £45,885 brought forward, making £100,247. From this must be deducted interest on debenture stock, £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, £8,294; leaving an available balance of £68,452. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum (less income-tax), being 10s. per share, whereof 5s. (less income-tax), was paid on November 1st, 1909, and 5s. (less income-tax) will be paid on May 28th, 1910, £17,500; to pay a bonus of 5s. per share (less income-tax) on May 28th, £8,750; carrying forward £42,202. The value of the business done by the company during 1909 showed a considerable reduction as compared with that of recent years; but, seeing that 1909 was unfavourable to nearly every branch of the electrical and engineering industry, the directors are of opinion that the results now shown cannot be considered other than satisfactory. At no time for many years

past have the conditions under which the company's operations are carried out been more difficult than in the period under review. The quantity of work available was even less than usual, and the struggle for orders was, consequently, severe. This was especially the case in the home trade, where no new contract of any magnitude was carried out, and where even the orders for extensions to existing mains were less in number and smaller in value than customary. Whilst this was doubtless due in part to the extended use of metal-filament lamps, it was greatly intensified by the universal depression which prevailed, and by the uncertainty in the financial outlook throughout the country generally. It is, therefore, with considerable satisfaction that the directors notice the improvement in trade which has taken place since the beginning of this year, with the consequent increase in orders which have been placed with the company. Although foreign and Colonial business was not so extensive in 1909 as in previous years, it has not suffered to the same extent as the home trade. Arrangements have been made for the representation of the company's interests in several markets hitherto untouched. Whilst the operations of the company on the Continent, carried on through the German Co., have been quite satisfactory, it is the intention of the directors to extend the usefulness and activity of that office during the coming year. Satisfactory relations have been established in Belgium, which, during the last 12 months, have resulted in several important contracts having been secured in face of strong Continental competition. The company's engineering department has been considerably extended, and its business increased. A satisfactory connection is now being built up in the South of England in foundry and general engineering work, entirely outside the cable business. The Anchor Cable Co., Ltd., has again done well, and in spite of the extraordinary rise which has taken place in the price of rubber, has been able to show even better results than in 1908. The factories, both at Erith and Leigh, have, since the beginning of this year, been well supplied with orders, and unless unforeseen events happen in the political or commercial situation, there is, in the opinion of the directors, a more promising outlook for business than has been the case during the past two years. The great disaster which has befallen the Empire by the death of His Majesty King Edward VII, may modify to some extent these hopeful expectations, especially in regard to the immediate course of business. The machinery, plant, and appliances, both at the factories and on the outside contracts at home and abroad, have, as usual, been maintained in a thoroughly efficient condition, and the cost of so doing has been charged against the year's accounts. The directors refer to the loss sustained by the death of Major W. M. Mackenzie, who had been a member of the board of this company since its formation in 1896.

Eastern Extension, Australasian and China Telegraph Co., Ltd.

The seventy-third half-yearly ordinary general meeting was held on Tuesday at Electra House, Finsbury Pavement, Sir J. Wolfe Barry, K.C.B., presiding.

At the outset of the proceedings the Chairman referred to the great loss which the nation had sustained by the death of the King and proposed the following resolution, which was seconded by the Marquis of Tweeddale and carried in silence:—

> That the shareholders of the Eastern Extension, Australasian and China Telegraph Co., in general meeting assembled, humbly beg leave to express to His Majesty the King their profound grief at the death of his illustrious and universally beloved father, King Edward VII, and to offer their personal sympathy with His Majesty and the Royal Family in their bereavements. The shareholders further ask to be allowed to express their profound and dutiful attachment to the Crown and their heartfelt sense of loyalty to His Majesty.

The Chairman, in proposing the adoption of the report, said that when he last had the pleasure of addressing the shareholders he mentioned that the commercial depression which had prevailed in the Far East for some considerable time, and had adversely affected their traffic receipts, appeared to be at last passing away. The improved report and accounts now before the meeting showed that the views he then expressed were justified, and he was happy to say that the present outlook appeared to be still encouraging. Dealing with the figures for the past six months, it would be seen that the gross receipts amounted in round numbers to £315,000, against £307,000 for the corresponding period of 1908, showing an increase of £8,000. The actual result, however, was better than these comparative figures indicated, seeing that £15,000 of exceptional revenue in connection with the Tasmanian cables was included in the accounts for 1908, which did not appear in the present accounts; consequently, if this exceptional revenue were left out of the comparison, the receipts would show an increase for the half-year of, roundly, £23,000. The working and other expenses amounted, in round numbers, to £143,000, against £151,000 for the corresponding period of 1908, showing a decrease of £8,000, which was principally due to the expenses attending the maintenance of their cables having been considerably less during the past six months, than in the same period of the previous year. Comparing the figures for the whole year, the results are as follows:—The gross receipts amounted to £606,000 for 1909, against £597,000 for 1908, or an increase of £9,000. The expenditure amounted to £337,000 for 1909, against £339,000 for 1908, showing a decrease of £2,000. Thus, in spite of the depression in the first half of 1909, the net result of the past year's working was £11,000 better than in 1908. The net profit for the half-year was, roundly, £152,000, and, after adding nearly £59,000 brought forward from the previous half-year, there remained an available balance of £211,000. The usual quarterly interim dividends of 2s. 6d. per share were paid during the past year, and it was now proposed to distribute a final divinend for the year of like amount, making a total dividend of 5 per cent. It was also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution for the year 1909 of 7 per cent. on the share capital. The usual additions had been made during the past year to the maintenance ships, insurance and depreciation funds, and, after applying £50,000 of the revenue balance to the general reserve fund, the sum of £26,000 is carried forward, or £8,000 more than in the corresponding period of 1908.

The Marquis of Tweeddale seconded the motion, and the report was adopted.

West Coast of America Telegraph Co., Ltd.

Sir John Denison-Pender, K.C.M.G. (chairman), presided at Electra House, E.C., on Tuesday, over the annual meeting of the above company, and, before commencing the ordinary general business, referred to the death of the King, and expressed the hope that the first thought of the British Empire would be to make King George V as great a monarch as he whom he had succeeded.

In moving the adoption of the report (see Electrical Review, page 749), the Chairman said that as regarded the traffic they were £2,000 down, which was not a serious thing, and it was due to the falling off of local traffic and to the fact that the cable was interrupted for 67 days during the year, as against 57 in the preceding year, which meant, of course, that the opposition got the traffic which would otherwise go over their lines. Unfortunately, the expenses were £6,000 up. In 1908 the expenses were £33,200, and in 1909 they were £39,200. This looked a very considerable figure, but he thought he could satisfactorily explain the items. The first increase was in allowances on the coast, which they had had to make as living was becoming dearer, and there was also the value of the Chilian currency, which made a considerable difference. These items, with increases of rents, rates and taxes, and the opening of an agency at La Paz, accounted for £2,000 increase. Cable work was not like a manufactory, where the staff could be reduced when there was no work to do. A great many of their clerks were sent out from England, and the local men also had to be retained; and consequently, whether the traffics were heavy or not, the standing charges remained pretty much the same. With regard to the remaining increased expenditure, repairs had cost them considerably more, and the ship had been 10 days longer at work than in the preceding year, whilst the amount of new cable put in had been considerably more also. He had always considered that the cost of repairs of cable ought not to be included in the general expenses of the year, because they might assume if they put in more cable in one year, they had taken out bad cable, which gave that portion of the cable, at any any rate, a new life. Therefore, they might hope if they got an excessive expenditure for cable maintenance in one year to get relief in future years, and if they could manage it—although it would be very difficult—it would be well if cable repairs could be spread over a period of years. In 1908 they received £1,500 for the charter of the steamer, whilst last year the steamer was not chartered, and therefore they were minus that amount. As they were told last year, they had had to replace the old steamer, which was 31 years old, with a new one, which had cost them, roughly, £20,000. They had written down the old steamer to £10,000, and had received £3,000 for her, which left a loss of £7,000. During later years they had put £12,000 by as a steamer depreciation fund, so that the cost of the new steamer was, to a certain extent, reduced, and at £20,000 she was by no means an expensive boat. She was doing her work well, and was a much steadier boat than the last one. By carrying out a quantity of cable which the company would have otherwise had to send out by ordinary steamer, they had also saved about £2,100, which really went in reduction of her cost.

Sir A. J. Leppoc Cappel seconded the motion, and the report was adopted.

A dividend of 2½ per cent. on the ordinary shares was declared.

Companies Struck off the Register.—The following have been struck off the Register and are dissolved:—

Electrical Bleaching Co.
Electrical Regulating and Lighting Syndicate.
Electrical Supplies, Rubber and Ebonite Co.
Electric Lamp Regenerating Co.
Electric Railways Co.
Electro-Voelker Syndicate.
McGuire Manufacturing Co.
Meyra Electric Co.

City of Carlisle Electric Tramways Co., Ltd.—The *Financial News* of May 10th contains a copy of a circular issued to the shareholders informing them that owing to the depressed state of the business, the profits last year not being sufficient to pay the debenture interest, and to the absence of signs of improvement, as well as to the necessity for expenditure shortly upon permanent way, overhead equipment and other renewals, they had, in the hope of saving something for the shareholders, negotiated an offer for the sale of the undertaking. The agreement so far negotiated provides for the sale for £7,000, subject to the debenture debt of £40,000, and subject to the shareholders' approval in general meeting. To avoid the heavy expense of liquidation, it is proposed to purchase all the shares from existing shareholders at 2s. 2d. per share. The investments of the reserve fund will also be available for distribution. Shareholders have been asked to express their views by May 20th.

Urban Electric Supply Co., Ltd.

Mr. P. D. Tuckett (chairman) presided on Wednesday, May 4th, at Salisbury House, E.C., over the ordinary general meeting of the above company.

The Chairman, in moving the adoption of the report (see Electrical Review, page 709), said the accounts disclosed satisfactory progress. The profits earned at the various works had increased by £6,059, whilst the total profit appearing on the credit side of the net profit and loss account was increased by £6,173. Deducting this latter figure from the total of the various items on the debit side of the account, there was a balance of £3,622 to be made good by the contractors as compared with £9,764 a year ago, a reduction of £6,142. The additional profit represented an increase of 16 per cent., the largest increase they had realised since 1905, and this increase was spread fairly uniformly over all the towns, Stamford being the only one which had gone back, and in that case the decline was due to a large power-user having ceased to take a supply owing to the removal of his works. Two definite causes had contributed to bring about the favourable results shown, viz.: (1) Cheaper coal, representing a saving of something like £1,700, and (2) the weather, which, throughout a large portion of last year, was anything but congenial compared with the delightfully fine weather of the previous year. Against these favourable influences, however, they had to set off the temporarily adverse influence of the metallic lamp, so that there was no reason to doubt the substantial character of the progress made. He could at least assure them that no effort had been spared in their endeavour to bring about improved results, and he believed that the improved results shown were in no small measure due to such efforts. They sold nearly 1,000,000 more units, or 14 per cent. more than the previous year, the power and heating units representing an increase of 27 per cent., as against an increase of only 3 per cent. in the case of the lighting units. This increased output brought in an increased gross revenue of rather less than £5,000, at a reduced average price of 2·23d. per unit, as compared with 2·36d. for 1908, whilst the expenditure, in spite of the 14 per cent. increase in output, was actually reduced by over £1,000, the average cost per unit being 1·23d., as compared with 1·43d. for 1908, bringing down the ratio of expenditure to revenue from 53·4 per cent. to 48·5 per cent. During the year they connected the equivalent of an additional 39,093 33-watt lamps, an increase of 9 per cent., as compared with the 8 per cent. increase of 34,906 lamps in the previous year. This result was distinctly encouraging in view of the progressive decline in the rate of increase during the previous four or five years. Of course a large proportion of the new connections was for power, but so it always had been, and it was far from being an unsatisfactory feature. The capital expenditure during the year had amounted to £29,403, an increase of 2·7 per cent., whilst the corresponding "Amount due to contractors" had increased by £23,673, bringing the total amount of the debt to £235,171. During the current year and next year considerable capital expenditure would be incurred in connection with the development of the Cornish undertaking, with reference to which it might be desirable for him to say a few words. On the assets side of the balance-sheet, there was a new item, "Cornish Electric Power Co. Investment at cost £551 10s." The promoters of the Cornish Power Co. secured a Special Act of Parliament in 1902 at a cost of several thousand pounds. Fortunately for the company, owing to the very adverse market conditions prevailing from that time forward, especially in electrical securities, they failed to find the necessary capital to enable them to proceed. It was doubly fortunate for the Urban Co., not only because it had enabled them to secure most valuable powers at a comparatively trifling cost, but also because the promoters' development of the business would have cut the Urban Co. off from the one and only possibility of ever turning a poor and unprofitable undertaking into a profitable one. In addition to an expenditure of £53,000 on their tramway undertaking, they had sunk on their supply undertaking at Camborne and Redruth over £120,000, on which they obtained a net return of only 3·7 per cent. for the year 1908. Apart from the development of a power load, any advance on this return must have been slow, owing to the extremely poor character of the district from a lighting point of view. As a field for power supply, however, the district held out the brightest prospects. There were many thousands of horse-power within a radius of a few miles, and although the Cornishman was somewhat cautious in his adoption of new methods, electrical driving was coming to be regarded with steadily increasing favour. They had recently entered into a contract with Dolcoath, the premier mine of the district, for a very considerable supply of power. They were already giving a supply of power to South Crofty and East Pool mines, and they had several inquiries from other large potential users. Already the return of their capital has risen from 3·7 per cent. in 1908 to 4·6 per cent. in 1909, and altogether they were very hopeful of their prospects, although they did not anticipate that any benefit to be derived from the pending developments would be reflected in the current year's accounts, the Dolcoath supply not being required until next year. Indeed, owing to the very heavy tramway repairs, with which they were faced this year, it was not improbable that the undertaking would show a reduced net profit for the year. The debenture stock outstanding was reduced by £3,300, the year's interests charge, appearing in the net profit and loss account, being reduced by £109. These reductions were due to the sinking fund, which came into operation for the first time last year; and in this connection there was at any rate this consolation to be derived from their impaired credit, that it had enabled them to acquire their debenture stock at a substantial discount. The reserve for depreciation which was increased this year by £1,971, provided the fund from which the sinking fund provision was drawn, whilst the profit resulting from the acquisition of their debenture stock at a discount had been applied in reduction of the item "discount and stamp duty on debenture stock issued." There was a new item appearing on the liabilities side of the balance-sheet "instalments received in redemption of capital expenditure on wiring, and motors on hire." This alteration was at present more a matter of book-keeping than one of substance, and was, therefore, of no great immediate interest, but as the item would be an annually recurring one, and might eventually represent, to a substantial extent, a reserve provision against loss in connection with such installations, he would try to explain it, although the explanation might prove somewhat complicated for them to follow. Hitherto, the outstanding cost of installations, carried out on a hire-purchase basis, had been included in the accounts under the head of debtors, the instalments, as they were received, being applied, in so far as they represented principal, in reduction of the outstanding debt, whilst any balance remaining over after completion of the transaction was carried to profit and loss account; and that was under ordinary circumstances the natural and proper way of dealing with the item. In these accounts, however, the cost of such installations was included, and it was proposed that in future it should continue to be included, as part of the capital expenditure under the heading "wiring and motors on hire," the debtor item of "wiring accounts at various towns" being correspondingly reduced, whilst the capital instalments received in respect of each installation would be held up in this new item on the other side until the particular installation was paid for in full. The amounts would then be cancelled out, and any balance remaining over would be held up as a reserve provision, instead of being carried to profit and loss account. Similarly, where a consumer failed to complete the purchase of his installation—as was not unlikely to be increasingly the case now that they were insisting on hire-purchase terms where previously they would have been prepared to concede free wiring ones, since many of such consumers were only tenants of the houses which they occupied—the property in the installation would revert to them, and would properly be included in the capital account, where it would accordingly remain unless and until purchased by the landlord or some succeeding occupier, any instalments which might have been received being held up as a reserve as in the former case. Again, in connection with their so-called free wiring, which had always been included in the capital account, they had arranged gradually to allocate to this new fund all rentals in excess of a certain percentage instead of carrying the whole of them, as heretofore, to the credit of profit and loss account. The balance from this source was not, he regretted to say, likely to be a large one for some time to come, but the altered method of allocation was at least a step in the right direction, for the importance of making some direct provision against the heavy losses which they would inevitably sustain in connection with their free wiring was only too apparent from the recurring item of wiring and motors on hire in suspense, an item which was increased this year by a sum of no less than £2,725. Before leaving the subject of installations on hire, it might be of interest to them for him to mention that the Electric Lighting Act of last year contained, amongst some other useful provisions, a very valuable one for them, inasmuch as it provided that all such installations shall remain the property of the undertakers, and shall not be liable to seizure by landlord, mortgagee or execution creditor simply by reason of the fact that they were upon the consumer's premises or attached to the freehold thereof. As they had nearly £139,000 falling under this head, he need not tell them that this was a matter of considerable importance to them. He had nothing to add to what he had said on previous occasions with reference to the unsatisfactory items to which the auditors called attention in their report. During the currency of the guarantee, it was impossible for them to deal with them. He would, however, remind them that this was the last year of the guarantee. After December 31st next, when their contract with Edmundsons expired, they would be dependent on their own resources, subject to any new arrangement they might make. Dividends would be dependent on their earnings and on the policy they adopted in connection with their disposal, and, since the debt owing to the contractors would then be bearing interest, it was clear that the ordinary shareholders must for a time forego any hope of a dividend. Before the end of the year it would be necessary for them to consider their position with reference to the question of future management, and in view of its important bearing on the future of the company, they proposed to submit for their approval any renewal of the arrangement with Edmondsons which they might entertain, for that was, he thought, the form any new arrangement was almost certain to take. The interests of both companies were so close, and the convenience and economy of working together were so undoubted, that it appeared to be simply a question of the terms on which such an arrangement should be based. At the same time that they called them together for this purpose, he thought it was not at all unlikely that they would submit a proposal for writing down the capital to a moderate extent. He could not say now what form it would take, but it was quite clear that some such action was required, if the continuance or early resumption of dividends was to be justified. With reference to the general progress of the business and their immediate prospects for the current year, for the first quarter he regretted to say they had not done as well as he could wish, insofar as they showed only a comparatively small increased profit over the corresponding quarter of last year. This was due to a want of expansion in the output, or even in some cases to a reduced output, an experience which had, he believed, been shared by many other electric lighting undertakings. How far it was attributable to the influence of metallic lamps, and how far to the weather, it was difficult to say, but that the weather had been exceptionally bright throughout the quarter and had

largely contributed to the result shown, there was no doubt, and the fact that Easter fell this year in March instead of April had undoubtedly affected the returns adversely. Whatever the cause, however, they felt satisfied that it was a passing and temporary one, which need occasion no serious anxiety. In the matter of lamp connections, he was glad to say they continued to maintain their rate of progress, and he thought there were distinct indications that the metallic lamp was stimulating new connections. As to its adverse influence on the output, speaking generally and subject to any further improvement in the efficiency of the lamp or reduction in the candle-power of the high voltage lamp, they might consider that they had now felt its full effect, so far as shops and similar class premises were concerned. In private houses there still remained a wide field for its adoption. In this direction, therefore, they might continue to feel the effect of its adoption for some little time, but inasmuch as its adoption by private residents was likely to be more gradual than in the case of shops, and was, moreover, in most cases equally likely to be accompanied by an increase of candle-power, he saw no reason to anticipate that they would not be able by new connections to more than make good any temporary check which this adverse influence might exert. That the metallic lamp was their very best friend, and had established the business on an infinitely stronger foundation than that on which it previously rested, there could be no manner of doubt. As the price of its good offices he was afraid they might have to be content for a time to see their profits expand at a somewhat slower rate than they might otherwise have expected, but, although this might be the case so far as their lighting load was concerned, they must not lose sight of the fact that they had a very considerable power load which was entirely unaffected by the lamp question. Moreover, they were doing all they could to bring to the notice of their consumers the various accessory uses to which they could put the supply with convenience, and, in many cases, with economy, to themselves. Marked improvements had recently been made in heating, cooking and other electrical apparatus, and he had no doubt that this would continue to be the case, with a corresponding reduction in price as the demand increased. Speaking generally of the prospects of the current year, he thought they might hope to wipe off the greater part of the debit balance of £3,622 appearing in this year's accounts, but with little, if any, assistance from cheaper coal, with the heavy repairs to be undertaken on the Camborne and Redruth tramways, and with the poor start which they had made in their first quarter, he would be satisfied if they did this and agreeably surprised if they did more.

Mr. E. Charrington, in seconding the motion, said that Mr. Owen and himself were in the Redruth district last week, and were very favourably impressed with the amount of business which was undoubtedly to be picked up, not only for the mines, but in other directions. They had to expend money in putting up another station on the coast, where they would save 2s. 6d. a ton on coal and would get much better water for condensing purposes. The mines were doing much better, and, when talking to one of the engineers, he was told that, if the company could get their cables to the mines, they would be welcomed with open arms. As to future arrangements with Edmundsons, they could rest assured that they were working together harmoniously. Mr. Tuckett was the chairman of both companies, but he had the capacity of looking at things from all sides, and anything which the directors of the company not interested in Edmundsons had put forward, had been most fairly considered.

The report was adopted without discussion.

Mr. Charrington and Mr. Owen were re-elected directors, and the latter gentleman, in reply, said he had no financial interest in Edmundsons, and kept a watchful eye solely on the Urban Co.'s interests.

On the motion of the Chairman, seconded by Mr. Owen, a vote of thanks was accorded the staff of the company.

Replying to a vote of thanks, the Chairman said it was only a question of time for the board to recover the shareholders a part of their money, if not the whole of it.

Johnson & Phillips, Ltd.

The directors in their fifth annual report state that for the year ending December 31st, 1909, the profit on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £3,691 for maintenance of buildings, plant, &c., amounts to £15 359, plus £681 brought forward = £16,040. Deduct remuneration of directors, auditors' and trustees' fees, £1,504; interest on debenture stock to December 31st, 1909, £7,851; reserve re debenture sinking fund, £5,060; interest on second debentures to December 31st, 1909, £684; leaving to be carried forward £942. The business of the company was adversely influenced by the depression in trade throughout the country. The disinclination generally shown to place large orders, and consequent active competition, kept prices low, while the cost of raw materials ruled high. In October, the compounding shop was destroyed by fire. While the company incurred no direct loss, considerable difficulty was occasioned to the cable department, and it was necessary to equip temporary premises to avoid delay in the execution of contracts. The capital account has been increased only by the comparatively small amount of £869, while substantial improvement has been effected, and paid for out of revenue. The profit for the year shows an increase of £5,322 over the preceding year. Should the electrical trade improve, of which there seems to be some indication, the directors believe that the company is in a position to secure its full share of any business increase. Mr. Frank Sydney Paterson has, since the date of the last general meeting, retired from the board. The directors have appointed Mr. Walter Claude Johnson and Mr. Thomas Dence as additional members of the board. These gentlemen offer themselves for re-election. Mr. Robert W. Blackwell also retires, and offers himself for re-election.

The auditors in their certificate draw attention to the fact that no depreciation has been written off freehold property, plant, machinery, &c.

Alderley and Wilmslow Electric Supply, Ltd.

The directors' report which was presented at the meeting held on April 26th, states that during the year 1909 further progress has been made by the company, the total connections having been increased from an equivalent of 17,725 to 19,114 8-c.p. lamps. The profit on working, including £64 brought forward, amounts to £1,857, and after paying £1,352 interest on debentures and loans, there remains a balance of £504, of which the directors recommend that £500 should be put to the reserve fund, and the balance of £4 8s. 5d. carried forward. Mr. F. E. Gripper retires, and offers himself for re-election.

Units generated	184,773
Units sold :—Public lamps	18,406
Private consumers by meter	120,934
Quantity used on works	38,424
Total quantity accounted for	177,764
Quantity not accounted for	7,009
Lamps connected January 1st	17,725
Lamps connected December 31st	19,114

Calcutta Electric Supply Corporation, Ltd.

The directors' report for the year 1909 states that during the year 7,856,383 units of electricity were sold, compared with 6,765,792 units in 1908, an increase of 1,090,591 units. The number of houses connected at December 31st last was 5,078, compared with 4,396 at the same date in 1908—an increase of 682, and the equivalent connections in 8-c.p. lamps show an increase of 73,437. The following figures show the comparative results for the past four years:—

Year.	Houses.	Equiv. in 8-c.p. lamps.	Units sold.	Gross revenue.	Net revenue.
1906 ..	3,060	262,893	4,578,380	£89,242	£50,176
1907 ..	3,721	320,863	5,487,883	£103,360	£57,275
1908 ..	4,396	378,835	6,765,792	£115,287	£58,188
1909 ..	5,078	452,272	7,856,383	£127,576	£67,024

Exchange is calculated at 1s. 4d. per Rupee.

A considerable demand has arisen in the Northern districts of Calcutta for electrical energy for power purposes, and the board were advised that steps must be taken without delay to meet this demand. In order to do this, and at the same time to economise the cost of production, it was proposed to erect a large high-tension generating station at Cossipore. To meet the capital outlay required for this scheme, the board invited, in July last, subscriptions for the remaining 80,000 preference shares. Of these, 40,350 shares have been subscribed for and allotted at the date of this report. Mr. Jenkin (of the firm of Sir Alexander Kennedy and Jenkin, electrical engineers) has visited Calcutta, at the request of the board, to advise what shall be done, and on his recommendation the board has decided to place at once some additional plant in the Ultadangha station of the company, which plant will be ready to commence supply in the northern districts by September 1st next. Messrs. Kennedy & Jenkin approve the proposed construction of the high-tension station, both for economical reasons and to meet the constantly growing demands for current. Some delay has been experienced in getting possession of the land, the site for the proposed new station, but arrangements have now practically been completed for the purchase. Sir Alexander B. W. Kennedy has been appointed consulting engineer to the company. The net profits for the year 1909 amount to £67,024 (compared with £58,188 in the previous year), to which has to be added the balance brought forward from 1908, £3,304, and after deducting the interim dividend at the rate of 6½ per cent. per annum paid in November, 1909, on the ordinary shares, and the dividend paid and accrued on the preference shares, together with the other items set out in the net revenue account, there remains an available surplus of £46,134, compared with £41,669 in the previous year. The directors recommend that a sum of £17,000 be placed out of profits to the credit of the depreciation and renewals account, and that a final dividend for the second half-year, at the rate of 9½ per cent. per annum, be paid on the ordinary shares (making 8 per cent. for the year), which will leave a balance of £5,492 to be carried forward, after providing for the directors' extra remuneration of £1,277. There is no diminution in the flow of applications for current, as is proved by the additional connections equivalent to 73,437 8-c.p. lamps during the last year, compared with 57,972 in the previous year. There is everything, therefore, to justify the belief in the continuance of the prosperity and success of the company.

The units delivered to consumers during the four weeks ended February 25th, 1910, were 439,285, compared with 379,751 units in the corresponding four weeks of 1909, and during the five weeks ended April 1st, 1910, they were 743,651, compared with 693,472 units in 1909.

Held Over.—Reports of a number of City meetings held on Wednesday will appear in our next issue.

MARKET QUOTATIONS.

Wednesday, May 11th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal)	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	..
a Copper Sulphate	„	£18	..
a Lead, Nitrate	„	£26	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %)	per ton	£20	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	70/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %)	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a „ Cyanide (basis 100 %)	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£80	..
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅞d.	⅛d. dec.
c „ Tube (brazed)	„	8⅜d.	⅛d. dec.
c „ „ (solid drawn)	„	6⅜d.	⅛d. dec.
c „ Wire, basis	„	6⅜d.	⅛d. dec.
c Copper Tubes (brazed)	„	8⅜d.	⅛d. dec.
c „ „ (solid drawn	„	7⅛d.	⅛d. dec.
g „ Bars (best selected)	per ton	£70	..
g „ Sheet	„	£70	..
g „ Rod	„	£70	..
e „ (Electrolytic) Bars	„	£60	..
e „ „ Sheets	„	£76 5	..
e „ „ Rod	„	£64 15	..
e „ „ H.C. Wire	per lb.	7⅞d.	..
f Ebonite Rod	„	6/-	..
f „ Sheet	„	5/6	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	6/6 to 11/-	..
h India-rubber, Para fine	„	10/3	1/7 dec.
i Iron Pig (Cleveland warrants)	per ton	49/10	4d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Ingot	„	£18 15 to £18 17 6	17/6 inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 18 to £9	dec.
d Mica (in original cases) small	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/8	..
p „ „ rolled strip & sheet	„	1/8	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	8⅞d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£149 to £150	..
n „ Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:— "Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh's (Vieille Montagne bnd.)	„	£26	15/- dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notices—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Llandudno and Colwyn Bay Electric Railway.—99,400 shares of £1 each, fully paid, Nos. 1 to 99,400. (Special application.)

And to allow the following securities to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—Further issue of £28,500 5 per cent. mortgages (redeemable) of £100 each. Registered.

The Committee have ordered the undermentioned to be quoted in the Official List:—

Shawinigan Water and Power Co.—$500,000 additional capital stock.
Manaos Tramways and Light Co.—£300,000 5 per cent. first debentures, Nos. 1 to 3,000 of £100 each, in lieu of the Scrip.

Chloride Electrical Storage Co., Ltd.—A dividend at the rate of 6 per cent. has been declared on the preference shares.

STOCKS AND SHARES.

Tuesday Evening.

The shock of last Friday's tragical news had been, to a very large extent, discounted in the Stock Exchange beforehand, and, in consequence of this, markets opened the week with an outburst of strength. Consols were prominent in an all-round rise, which was based as much upon sentiment as the previous fall had been. The advance, generally speaking, wiped out the earlier decline, and prices have suffered far less than many people expected would have been the case.

Home Railway stocks had been acutely depressed on the issue of the penultimate grave bulletin, but in their case the recovery was rapid and substantial as regards the steam stocks. The electricity section is rather governed by special conditions.

It is obvious, for instance, that the Shepherd's Bush Exhibition will be shorn of much of its expected brilliancy and support. The Central London Railway must, therefore, suffer to some extent. The Metropolitan and the District Companies will be somewhat similarly affected, and the District, moreover, is about to lose its indefatigable head (Sir George Gibb), who has resigned his railway positions in order to take up the chairmanship of the new Road Board. Sir George Gibb has done wonders both for travellers upon, and proprietors in, the District Railway and its allied undertakings, yet the price slipped back no more than ½, which it regained later, while Metropolitan Consolidated is ¼ lower, and the Surplus Lands fell 1.

Brighton Railway stock has been well maintained, although the uncertainty attaching to the Pageant at the Crystal Palace—a function which was expected largely to benefit the railway company—is by no means a bull point. Underground Electric Railway issues are unchanged on the resignation of Sir George Gibb. City and South London fell ½, because of the blow to the Anglo-Japanese Exhibition.

British Electric Tractions have fallen away again, the Ordinary losing 2s. 6d., and the Preference 7s. 6d. This market lacks stability, and is very narrow; hence it requires but little demand or supply to move the nominal quotations abruptly. British Westinghouse Debenture now that it has at last begun to move is 4½ points to the good. British Thomson-Houston Debentures rose 3, making 8 points in less than a fortnight. Business has been marked as high as 103 in the bonds. With these exceptions, industrials are on the dull side. Babcock and Wilcox take their place with the exceptions, and have again risen above £5, with a good deal doing in the shares. British Insulated shares, Ordinary and Preference, have weakened. Henley's are slightly lower, and so are Callender's.

In the case of a new issue made the other day by a company in very close touch with the electrical industry, the underwriters were saddled with the full amount of their obligation. As one of them remarked, there are occasions when words entirely fail. For ourselves, we do not remember having come across such an instance before, in which public subscriptions must have been *nil*, or next door to it.

British Columbia Electric Railway Deferred Ordinary stock is down 2, but the Preferred rose a point. Anglo-Argentine trams are better, and Mexicos unchanged, although the bonds have gone back a trifle. London United Tramways issues continue to recede, and the Debenture stock at 67½ shows a fall of 3.

Mexican Light and Power bonds are ⅝ lower, the Common shares remaining unaltered. London shares are quiet. Metropolitans fell ¼, and so did Westminsters. Urban Preference rose ⅛. It is thought that the death of the late King, stopping entertainments and many of the chief functions of the coming season, will have a bad effect upon the receipts of the electric light companies that operate in the West End. No doubt it will have some influence in this way, but no substantial difference is likely to be felt, so far as can be estimated at present by good authorities. River Plate Electricity shares are *ex* their annual dividends on Preference and Ordinary, the prices remaining unchanged after the deduction of the 1s. 2¾d. and 1s. 9¼d. respectively. If this company were to make the departure of splitting its dividend payments into half-yearly instalments, its shares would undoubtedly become more popular with investors, who like to get their cheques at least twice in the twelvemonth.

Telegraph and Telephone descriptions are more or less marking time. There is hardly a movement worth noticing all through the list. Mackay Common fell 2 on Wall Street sales, and the Preferred lost 1. American Telephone and Telegraph capital stock is easier. Indo-Europeans are beginning to recover part of the dividend and bonus, and Western Telegraphs are ½ higher. National Telephone Deferred came to market. Telegraph Constructions had a further fall, a decline of 25s. carrying the price back to 33½ middle.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations May 3rd.	Closing Quotations May 10th.	Business done week ended May 10th. 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	3⅜ — 3⅞	3⅜ — 3⅞	..	..	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$235,196,600	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	138 —141	137 —140	..	..	—1	5 14 4
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 8
558,460	Anglo-American Telegraph	Stock	37½ %	31½ %	£3 4s.	38%	59 — 61	59 — 61	..	..	..	5 18 10
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —102	101 —102	101½	100½	..	5 17 8
3,220,770	Do. do. do. Deferred	Stock	12½ %	1 %	8/-	25/-	17⅞ — 18½	18 — 18½	17⅞	17⅞	— ⅛	6 15 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½ —101½	99⅛ —101⅛	..	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 1/16 — 8 3/16	8 1/16 — 8 3/16	..	..	..	4 16 3
2,449,176	Commercial Cable, Sting. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	86 — 88 xd	85½ — 87½	87	..	— ½	4 11 6
16,000	Cuba Telegraph	10	5 %	6 %	6 %	6 %	8½ — 9 xd	8½ — 9 xd	..	..	..	6 13 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	16⅞ — 17½ xd	16⅞ — 17½ xd	..	..	..	5 17 8
13,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	6 3 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8¼	7⅞ — 8¼	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 8
60,710	Direct United States Cable	20	4½ %	4½ %	4½ %	4 %	13½ — 13⅝	13½ — 13⅝	13½	..	..	5 18 6
39,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,300, R.	100	4½ %	4½ %	4½ %	4½ %	100 —102	100 —102	..	..	..	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	136 —139	136 —139	138½	136½	..	5 0 9
2,000,000	Do. 3½ % Pref. Stock..	100	3½ %	3½ %	3½ %	3½ %	86 — 88	86 — 88	87½	83⅜	..	4 1 5
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	101 — 103 xd	101 —103 xd	..	..	..	3 17 8
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	13 — 13⅛	13 — 13⅛	13 7/16	13	..	5 3 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	99½ —101½ xd	101 —103	..	..	+1½	3 17 8
200,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	99½ —101½ xd	99½ —101½	..	..	..	3 18 10
181,127	Globe Telegraph and Trust	10	5½ %	5½ %	5½ %	..	10¾ — 11	10¾ — 11	10 5/8	10½	..	5 4 7
181,127	Do. do. 6 % Pref..	10	6 %	6 %	6 %	6 %	13⅛ — 13⅜	13⅛ — 13⅜	13⅜	..	..	4 8 1
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	30½ — 31½	30½ — 31½	..	..	..	5 16 8
5,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,900, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 8
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	51½ — 53½	52 — 54	53½	53½	+ ½	6 18 0
$41,880,400	Mackay Companies Common	$100	8½%	4 %	4 %	4½%	88 — 93	86 — 91	..	..	—2	4 13 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 — 80	77 — 80	..	..	— ½	5 0 0
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜ — ⅞	37/64 — 39/64	16/-	15/-	— 3/32	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	⅞ — 1 xd	⅞ — 1 xd	..	..	..	6 0 0
86,492	Do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	⅞ — ⅞ xd	⅞ — ⅞ xd	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105½	105	104	..	5 13 9
2,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	124 —126	123½ —125½	124½	123⅜	— ½	4 16 0
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	10⅛	10 1/16	..	5 11 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5 3/16 — 5 5/16	5 3/16 — 5 5/16	5⅛	5 5/16	..	4 11 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97 — 99 xd	97 — 99	97	..	..	3 11 8
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	98	..	..	4 0 0
179,813	Oriental Teleg. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	8 %	1 7/16 — 1 1/2 xd	1 7/16 — 1 1/2 xd	28/9	..	..	4 14 10
50,000	Do. do. do. 6 % Cum. Pref.... ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8 xd	1 1/16 — 1 1/8 xd	..	..	..	4 14 9
196,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	101½	..	..	4 8 3
9,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	128 —131 xd	128 —131 xd	..	..	..	4 11 7
190,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7 5/16	..	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 8 11
90,008	W. Coast of America, 1 to 80,000 & 83,001 to 83,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1½ — 1⅝	..	..	— ⅛	4 3 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13½ — 14	13⅝ — 14½	14½	13½	+ ½	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 18 3
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜ — ⅞	⅜ — ⅞	..	..	..	Nil
94,558	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	..	8⅜ — 9½	8⅜ — 9½	8⅜	..	..	6 9 9
4,689	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8½ — 9½	8½ — 9½	..	..	..	6 9 9
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½ —102½	101 —103	..	..	+ ½	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4 5/16 — 4 3/8	4 1/4 — 4 3/8	96/10½	93/9	+ ⅛	5 2 7
500,000	Do. 5 % 2nd Pref., 800, to 1,800,000	5	..	..	..	5 %	4 7/16 — 4 1/2	4 7/16 — 4 1/2	..	..	..	5 6 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ — 92	90½ — 92	91½	90½	..	4 7 0
882,887	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	105 —107	105 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	24 %	4½ — 5½	5 — 5½	5⅛	99/4½	+ ⅛	4 11 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8 xd	1 1/16 — 1 1/8 xd	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	..	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	..	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	..	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	145 —150 xd	142 —147 xd	145½	142	..	5 8 7
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	121 —125	122 —126	124	122	+1	4 15 8
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —110	107 —109	107½	107	—1	4 11 9
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —103	102 —104	..	..	+1	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,801	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	⅞ — 1⅛	..	..	— ⅛	Nil
161,487	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1½%	..	3⅞ — 4⅛	3⅞ — 4	7/9	72/6	+ ⅛	3 15 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93	94½	91	..	5 7 6
528,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	66 — 71 xd	66 — 71 xd	..	..	..	6 6 9
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	10 %	6⅞ — 7⅛	6⅛ — 7	6⅜	..	— ⅛	7 2 10
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6½	5⅞ — 6⅛	..	..	— ⅛	4 16 9
500,000	Do. do. 4½ % 1st Mort. Deb. Red..	100	4½%	4½%	4½%	4½%	104 —106	103 —106	103	102½	..	4 4 11
204,940	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	98 —101	101 —104	..	..	+3	4 6 7
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	⅜ — 7/16	⅜ — 7/16	..	..	..	Nil
1,316,353	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	52 — 55	53½	48½	+ 4	7 5 6
60,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	7/16 — ½	7/16 — ½	..	..	..	bal
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	4½%	4½%	4⅜ — 4½ xd	4⅜ — 4⅝ xd	90/7½	..	..	4 12 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,830..	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	96/8	..	..	5 0 0
350,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	98 —101	..	..	—1	4 9 1
85,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10 — 10⅜	9⅝ — 10⅜	10	..	— ⅛	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
360,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	4 6 2
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1/16 — ⅛	1/16 — ⅛	..	..	..	N.I
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅛ — 2⅜	2⅛ — 2⅜	55/-	54/3	..	4 7 9
310,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	70 — 72	69 — 71	70	..	—1	4 4 6
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	86½	..	4 10 11
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	53½	..	..	3 12 9
1,480,000	City and South London Railway	Stock	2½%	2⅜%	1½%	1⅜%	34½ — 35⅜	34 — 35	34½	34½	— ½	5 0 0
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	⅜ — ⅞	⅜ — ⅞	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations May 3rd.	Closing Quotations May 10th.	Business done week ended May 10th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	* 1	10 %	10 %	6 %		⅞ — 1	⅞ — 1	..	..	..	6 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000	1	6 %	6 %	6 %	6 %	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	5 4 4
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,961	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,961	5	2½%	2½%	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	2½%	2½%	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
807,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	66	..	..	5 14 4
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
31,890	Do. do. 7 % Cum. Pref., 1 to 31,890	2	7 %	7 %	7 %	7 %	1⅝ — 1⅞	1⅝ — 1⅞	..	..	..	9 0 8
26,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86	82 — 86	..	..	..	4 13 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	1½%	Nil	..	¾ — 1	¾ — 1	16/3	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ — 10¾	10½ — 10¾	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103	102 — 103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12⅝ — 12¾	12 — 12⅜	12½	..	— ¼	6 2 0
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	4½%	5 — 5⅜	5 — 5⅜	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	4½%	105½—107⅛	105½—107⅛	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10 %	10 %	10 %	10 %	15 — 15⅝	14½ — 15½	14½	..	— ⅜	6 11 2
37,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	Nil	⅜ — ½	⅜ — ½	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5¼ — 5⅜	5¼ — 5⅜	..	..	..	8 13 11
600,070	London United Trams. (1901), 1 to 60,007	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
599,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1⅛ — 2⅛	1⅛ — 2⅛	..	..	..	Nil
195,000	Do. do. 5 % Cum. Pref., 1 to 195,000	10	5 %	5 %	3½%	..	2½ — 3	2½ — 2⅝	50/-	48/9	— ½	18 12 8
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	69 — 72	65 — 70	..	..	—3	5 14 4
5,782,062	Metropolitan Consolidated	100	1 %	1½%	1½%	1 %	43½ — 43⅝	43¼ — 43⅜	44	42½	..	2 5 9
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2½%	67 — 69	66 — 68	..	..	—1	4 0 11
3,285,000	Do. District	100	Nil	Nil	Nil	Nil	28 — 28½	28 — 28½	28½	22½	..	Nil
891,337	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	3⅛ — 3⅜	3⅛ — 3⅜	..	..	..	5 15 0
814,016	Do. do. Defd.	1	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
600,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	17/6 — 18/-	17/9 — 18/-	16/-	..	+ 3/32	5 19 5
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	97 —100	97 —100	98½	97½	..	4 10 0
$10,323,200	Mexico Trams Co., Common Stock	..	..	..	..	..	129 —131	130 —132	130½	..	+ 1	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	94⅜ — 95⅜	95 — 96	96	94⅜	+ ⅛	5 4 2
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	3/16 — 7/32	3/16 — 7/32	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/16 — 7/32	3/16 — 7/32	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	84 — 87	84 — 87	..	..	..	5 3 6
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	83½ — 85½	32½ — 34½	33½	31	—1½	6 13 4
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —101	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	100 —101 xd	100 —101 xd	101¼	100⅞	..	4 19 0
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	4½%	88 — 90	88 — 90	89½	89½	..	5 0 0
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	38 — 40	38 — 40	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	⅛ — ¼	⅛ — ¼	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1½ — 2½	1½ — 2½	..	..	..	1 4 2
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	65 — 75	65 — 75	..	..	..	5 6 8

ELECTRICITY SUPPLY COMPANIES.

50,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	⅞ — ⅞	⅞ — ⅞	9	7⅛	..	6 10 1
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	⅞	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4⅛	4 — 4⅛	80/-	..	..	6 11 1
80,000	Do. do. 4⅛ % Cum. Pref.	5	4⅛%	4⅛%	4⅛%	4⅛%	4⅜ — 4⅝	4⅜ — 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4⅛ % Cum. Prf.	5	4⅛%	4⅛%	4⅛%	4⅛%	8⅝ — 4⅝	8⅝ — 4⅝	..	..	..	5 2 10
445,795	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅝ — 4⅛	3⅝ — 4⅛	81/3	77/6	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
70,596	City of London Elec. Lighting, Ord. 40,001—110,596	10	6 %	6 %	6 %	7 %	11½ — 12	11½ — 12	..	..	..	5 16 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	12½	11¹¹/₁₆	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2½ — 3½	2½ — 3½	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 8	7⅜ — 8	7⅞	7⅞	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅞ — 11⅛	10⅞ — 11⅛	10⅝	..	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	108 —106	108 —106	106⅛	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	99 —102 xd	98 —101	..	..	—1	4 9 1
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	⅛ — ¼	⅛ — ¼	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	1½ — 1⅝	1½ — 1⅝	32/6	..	..	Nil
490,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	73 — 76	73 — 76	..	..	..	5 18 5
$8,150,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	82 — 85	82 — 85	..	..	..	5 17 8
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	5½%	4½ — 4⅝	4½ — 4⅝	90/-	..	..	5 15 3
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 15 3
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
15,000	Hove, 1 to 15,000	8	9 %	8½%	8½%	8½%	7 — 7⅛	7 — 7⅛	..	..	..	5 18 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½—104½	102 —104	102½	..	— ½	4 16 2
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1⅝ — 2	1⅝ — 2	..	..	..	4 8 11
70,000	Do. do. do 6 % Pref.	5	6 %	6 %	6 %	..	4½ — 5½	4½ — 5½	..	..	..	5 14 3
882,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	93	92	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	5 %	6½%	5 %	5 %	4 — 4⅛	3⅞ — 4⅛	81/3	75/-	— ⅛	6 17 8
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4⅛ — 4⅜	97/6	..	..	4 12 4
285,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	84½	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84½ — 85½	84½ — 85½	..	..	..	5 16 3
18,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	79 — 81	79 — 81	..	..	..	4 6 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	100 —102 xd	100 —102	100½	..	..	6 17 3
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	89½ — 90½	89½ — 90½	90	89½	— ½	5 10 10
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96½ — 98½	96½ — 98½	..	..	..	4 11 5
180,491	Newcastle-on-Tyne, 1 to 187,500	5	3 %	3 %	2½%	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	2 15 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅜ — 4⅝	4⅜ — 4⅝	..	..	— ⅛	5 5 8
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 —101	99 —101	..	..	..	4 19 0
10,883	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅞ — 12⅜	11⅞ — 12⅜	..	..	..	5 9 10
20,000	Oxford. 1 to 96 and 407 to 20,316	5	7 %	7 %	7 %	7 %	6⅞ — 7	6⅞ — 7	6⅞	..	..	5 0 0
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	2½%	6 %	8 %	9 %	1⅛ — 2 xd	1⅛ — 2⅜	40/7½	38/6	— ⅛	4 2 8
100,000	Do. do. 5% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1⅝ — 1⅞ xd	1⅝ — 1⅞ xd	21/10½	..	..	5 4 4
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8½ — 9	8½ — 9	8⅝	..	..	5 14 8
80,000	Do. do. 7 % Pref. 30,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	7⅛	..	..	5 7 8
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	3½%	84 — 88	86 — 88	87	..	+1	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅝ — 2⅛	1⅝ — 2⅛	..	..	..	Nil
66,000	South London Electric Supply, Ord.	4	3 %	4 %	5 %	5 %	2⅞ — 3⅛	2⅞ — 3⅛	..	..	..	6 9 0
180,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	98 —101	101½	..	—2	4 19 0
120,000	South Mes. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	⅜ — ½	⅜ — ½	..	..	..	5 0 0
149,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	21/-	..	..	6 4 5
294,530	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	½ — 1	½ — 1	12/6	..	..	20 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅞ — 2⅜	2 — 2½	..	..	+ ⅛	10 0 0
375,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	..	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	⅜ — ⅞	⅜ — ⅞	..	..	..	5 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8½ — 9	8¼ — 8½	8⅝	8¼	— ¼	5 14 3
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1908)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	5⅛	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent., March 17th. 1910.

PROCEEDINGS OF INSTITUTIONS.

The Physical Properties of Switch and Transformer Oils.

By W. Pollard Digby, A.M.I.E.E., and D. B. Mellis.

(Abstract of paper read before the Institution of Electrical Engineers *at* Manchester, *March 22nd*, 1910.)

(*Concluded from page* 717.)

A sample of a well-known brand of switch and transformer oil, of American origin, of the class referred to in this paper as H 1, having a specific gravity of 0·8588 at 60° F., examined in the authors' laboratory, gave the results stated in column A of the following table; columns B and C show the varying viscosities of (B) American oil of specific gravity 0·913 at 60° F. and (C) Russian oil of specific gravity 0·915 at 60° F., calculated from results published by Boverton Redwood. The oil B approximates to that which is designated elsewhere as H 5.

t° F.	A. Viscosity.	B. Viscosity.	C. Viscosity.
60·0	25·40	55·11	370·9
80·0	16·37	31·66	167·2
100·0	11·41	20·42	81·23
120·0	9·18	14·25	44·92
140·0	7·83	10·52	26·40
160·0	6·84	8·29	16·91

It will be seen that at 60° F. the viscosity of B is, roughly, double that of A; but at 120° F. it is only about 50 per cent. greater, whilst the difference rapidly diminishes at still higher temperatures.

As a rule, a viscosity higher than 70 or 75 is undesirable unless atmospheric temperature, load and duration of running are such that high temperatures are inevitable. Where such conditions do not arise a viscosity not exceeding 45 to 50 is to be preferred. Given equality in other respects, oils having the lowest viscosity should be selected for transformers. For switches, too, the use of an oil having a viscosity sufficiently high to prevent or seriously impede the subsidence of suspended matter is to be avoided.

In the course of the routine testing carried out by one of the authors on a consignment of about 800 gallons, 10 samples were taken from 10 out of the 21 steel drums containing the oil.

Three of the drums were rejected on the dielectric tests, representing 30 per cent. of the quantity sampled, and 15 per cent. of the entire order, this indicates the necessity of examining each drum or cask, if the properties called for in a specification are actually required.

The series of six special samples of oils submitted to dielectric tests both in their condition as received, and also after baking, as already described, were carefully examined in the laboratory, in order to determine whether there was any marked divergence between them. The results were interesting and suggestive rather than instructive and positive. The authors then arranged to study the properties of oils of the classes H 1, H 3 and H 5, after their use in extinguishing an arc due to a given current, broken a definite number of times in an oil-break switch. For this purpose Messrs. Mather & Platt, Ltd., kindly placed at their disposal a 30-B.H.P. three-phase 440-volt motor. This was loaded up until the current per phase was exactly 35 amperes, when the switch was tripped and the current broken at six points below the surface of the oil two hundred times in succession for each of the three oils.

The oils used were delivered by the firms supplying the types H 1, H 3 and H 5, and were fairly typical of the classes of oil in question. The following table gives their initial properties:—

Class of oil.	Specific gravity.	Flash-point, °C.	Viscosity.	Specific resistance. Megohms.	Colour.	Reaction.	Resinoid matter.
H 1	0·856	177	25·5	Over 6,500,000	Light golden yellow	Faintly alkaline	None
H 3	0·903	202	96·5	Over 6,500,000	Light sherry	Faintly alkaline	None (?)
H 5	0·872	193	65·0	Over 6,500,000	Red brown	Faintly alkaline	Trace

After the tests, their properties were as follows:—

Class of oil.	Specific gravity.	Flash-point, °C.	Viscosity.	Specific resistance. Megohms.	Colour.	Reaction.	Resinoid matter.
H 1	0·856	177	25·5	2,828,000	Light golden yellow	Neutral	Very distinct
H 3	0·900	204	94·7	945,000	Light sherry slight turbidity	Neutral	Slight
H 5	0·872	204	71·3	Over 6,500,000	Red brown	Practically neutral	Trace

The dielectric strength was generally greatly increased. With good oil, and protection from the ingress of dust or moisture, such a switch might be tripped a great many times before the physical properties of the oil fell below those of a number of the inferior oils only too often used. No carbon was visible, while the high specific resistance precluded the presence of anything save indeterminable quantities of conducting materials.

On account of the negative results arising from the investigation just described, the authors decided to try the effect of maintaining an arc between a copper ball and disk at a definite distance for a set time. The pressure selected was 10,000 volts, the sparking distance 60 mils. and time 180 seconds. So far as could be calculated the current flowing in the high-tension circuit of the transformer was 110 milliamperes. Visually there was a pronounced darkening of the oils which received this test—namely, H 1, H 3 and H 5. In each case the carbon produced was entirely of the amorphous variety.

The amounts of carbon were determined:—H 1, 0·00533 gramme per 100 c.c.; H 3, 0·02900; H 5, 0·02050.

Appendix.

Since submitting the MS. of this paper, the authors have had an opportunity of investigating an interesting case of the properties of the oil from a high-tension transformer after three years' use. The conditions were in every degree adverse. The transformer was frequently overloaded; on three occasions it had gone to earth through failure of the fibrous insulation on the coils, it had been worked without its cover, and had stood in a corner of a Manchester machine shop. Dust and similar foreign matter had free access to the oil. Of the grade of oil used, the works description was that it was mixed, and consisted of transformer oil purchased from two firms. The trade names indicated that these were of the classes designed as H 3 and H 5. Yet, after sedimentation, the dielectric strength curve of this oil was of an entirely normal character (almost identical with fig. 1).

The other properties were as follows:—Viscosity, 58·9; flash-point, 177° C.; specific gravity, 0·8683; specific resistance, 193,000 megohms; reaction, slightly acid; resin, small quantity; odour, suggestive of ozone.

The authors' thanks are due to Mr. F. E. Pollard, F.I.C., F.C.S., who prepared the section on the physical and chemical examinations of oils for the authors, and carried out all the tests as to chemical properties mentioned in this paper.

Discussion.

Mr. Beaver said that if the oils tested were arranged in order of merit, so far as the electrical and chemical properties were concerned, and in order of magnitude so far as the physical figures were concerned, there was a rough relation between the specific resistances and breakdown voltages, and between breakdown voltages and alkalinity or acidity, though not between breakdown voltages and resinoid contents. It was also noticeable that no relation existed between the physical and electrical properties, H 3 and H 1 being the best of the series and almost equally good electrically, but comparatively wide apart physically. He did not think the impurities indicated in the table accounted for the wide difference between the various oils in specific resistance and dielectric strength. His experience was that moisture was by far the most predominant source of variation in electrical properties. It was practically impossible to dry an oil perfectly by the application of heat, and it was certain that the elimination of the last traces of moisture from an oil would make far more difference to its electrical properties than would alkaline, acid or resinous substances, such as referred to in the table. There were such wide possibilities for the taking up of moisture in handling, packing and transit that the variations in one consignment referred to by the authors were not surprising. Physical and chemical properties which fixed the general character of the oil could be so easily adhered to by the oil manufacturer on the one hand, and the elimination of the moisture on the other hand, could be so easily ensured to a practically efficient extent by, say, filtration through beds of calcium chloride, that it seemed reasonable to think that the oil user was in a better position to take care of the electrical properties than the refiner. The question of moisture had hardly been given sufficient prominence where, in his opinion and experience, it was deserving. Alkalinity or acidity was of rare occurrence in mineral oils. Dealing with the experiments on the relation between dielectric strength and temperature, the general trend of the curves obtained for solid insulating materials was rather in the opposite direction to those shown for the various oils. He was inclined to think that this striking difference was due to the much better dissipation of heat in the path of stress in oils. Reference to the viscosity figures for these oils gave support to this view. He could not agree with the authors that makers of oil-cooled transformers were wrong in applying lower test pressures to transformers when they were heated up at the end of a test run, than after being allowed to cool; the dielectric which the transformer maker tested was not the oil, but various solid or laminated dielectric materials, which had, to some extent at least, reverse electrical characteristics to those of oils at high temperatures. The relation between fall of viscosity with temperature and electrical properties should prove exceedingly interesting, because the general order of decrease of viscosity with increase of temperature bore some relation to the surface tension of the oil, and the surface tension of the oil might be quite different in cases where oils of different origin gave identical results under physical tests at the usual testing temperatures. With regard to the detection of moisture, although the exsiccated cupric sulphate was very sensitive to the action of water, oil might be chemically dried, and improved electrically by such drying, beyond the point when this test ceased to be sensitive. The most delicate test was the stream of hydrogen bubbles given off from a small piece of sodium immersed in the oil, and as the nitro-prusside

test for the detection of sulphur entailed the use of metallic sodium, there would appear to be little use for the dehydrated cupric sulphate. Regarding indicators, he found no necessity for testing the aqueous extract while hot, and did not prefer tincture of cochineal to the more usual phenol-phthalein and methyl-orange. He had always found phenol-phthalein reliable, and did not understand the statement that it was not affected by the alkaline soaps. He had some doubt as to the identity of the resinous bodies to which the authors frequently referred, and wished to know whether they had been isolated as such or identified by such a test as the Liebermann-Storch test.

Mr. J. S. Peck said that from a practical point of view, there were three necessary qualities in oil used for transformers, viz., (*a*) high fire test; (*b*) high dielectric strength; (*c*) freedom from deposit under working conditions. The authors had dealt with (*a*) and (*b*), but had not touched upon the question of deposit at all. He hoped that investigations would extend to cover this question, for although there were oils on the market which were satisfactory as regards the fire tests and dielectric strength, it was very difficult to obtain an oil which would not throw down a deposit when worked at a comparatively high temperature. High dielectric strength was largely a matter of purity, while the method of obtaining a high flash-point was well understood. Regarding the question of deposit, however, very little appeared to be known beyond the fact that some oils exhibited this defect to a marked degree, whilst others were practically free from it. This might be said to be the most important question now confronting manufacturers and users of oil for insulating purposes. There was no advantage in purchasing expensive oil of great purity unless precautions were taken to maintain the purity of the oil during shipment. Oil would absorb a certain amount of moisture if exposed to a damp atmosphere, and when shipped in wooden barrels there was always a risk, especially when stored out of doors, that water would work in through the heads of the barrels. On this account, the use of wooden barrels for shipping and storing had been largely done away with. The authors had devoted considerable space to the question of the specific resistance of oil, but, in his opinion, this was not of practical importance, unless this formed some identification of the dielectric strength of the oil; from the results, this apparently was not the case. It was a very interesting fact that the dielectric strength of oil appeared to increase very rapidly with temperature, while the specific resistance decreased at an even greater rate. It would be interesting to know what would happen if the curves shown were repeated several times. Mr. Peck agreed with the remarks of Mr. Beaver, and therefore disagreed with the authors in regard to the statement that a transformer should not be tested with a higher voltage when cold than when hot, because the oil had little to do with the insulation strength, except in preventing surface discharges. Breakdowns usually occurred through the solid dielectric, and there was no doubt that this was weaker when hot than when cold. He presumed that the arcing effects were all obtained by breaking alternating current below the surface of the oil; experience indicated that the carbonising effect was much greater with direct than with alternating current.

Mr. J. Lustgarten said that of the properties mentioned as requisite in a mineral oil, one might add that evaporation must be small, and that no trace of sediment should occur after repeated heating and cooling. The sparking voltage depended on many factors which the authors had not mentioned. These factors were—

(*a*) The width of the glass vessel in relation to the spark distance, and the size of the electrodes.
(*b*) The position (depth) of the spark gap in the oil.
(*c*) The amplitude factor of the machine used.
(*d*) The rate of growth of the testing pressure.
(*e*) Whether the electrodes were insulated, or one was grounded.
(*f*) The shape of the electrodes.

The amplitude factor was important, because if the machine had a peaky wave, the oil would break down very much earlier. Earthing one electrode altered the maximum potential gradient on the insulated electrode. With regard to (*d*) a modification of the method was to move the electrodes, keeping the testing pressure constant. With regard to the shape of electrodes, he could not see why the authors got the voltage-distance curve for $\frac{3}{4}$ in. diameter spheres to lie below that of needle points, as it was known that in the air the voltage-distance curve lay above that of needle points. Speaking of his own results on oils, the larger sized spheres gave curves lying above the smaller size, and obviously the needle point was a very small sphere, and for a given sparking distance and voltage, the potential gradient was steeper with needle points. He had experimented with $\frac{1}{2}$ in., $\frac{3}{4}$ in., and 1 in. spheres, and had found better results obtained with larger spheres than with the smaller ones, but the distances had to be greater than $\frac{1}{2}$ in. With regard to the curves for spheres, these bent over as in the needle point curve. Dr. Russell, in a very excellent paper given some years ago, suggested that the best way of expressing the dielectric strength of an insulating material, was by the maximum potential gradient at breakdown. This for parallel plate electrodes immersed in the dielectric would be v/x, but for spheres $f\,v/x$, where v = maximum voltage, x = spark-gap distance, f a factor depending on x and the diameter of the sphere (here they saw the influence of the amplitude factor on v, and hence on the potential gradient). The dielectric strength of the best oils was about 160 kilovolts per cm.; medium oils, about 100. The potential gradient for the oil in the curves given in the paper was rather low—80 kilovolts per cm. The authors remarked that the dielectric strength improved with flashing over, and was due to traces of moisture and impurities being burned out. This was particularly apparent in an oil submitted him for test. The breakdown voltage went up from 42 to 80 kilovolts (R.M.S.) in 20 days with a test taken once every 24 hours, but after repeated breakdowns the strength diminished, 80, 71·2 and 63·6 kilovolts being readings taken on three consecutive days. In testing oil, sufficient time should be given to allow air bubbles to rise, and finely divided floating or colloidal matter to settle, as they would seriously affect the results, especially at a small sparking distance. In a particular case the breakdown voltage a few minutes after pouring in was 10 kilovolts, half an hour afterwards 17 kilovolts, and 24 hours later 48 kilovolts (in the latter test traces of moisture must also have been removed). The authors had found that the dielectric strength of oil increased with temperature. In solids it was the reverse. Did the authors find this to hold after repeated heating and cooling of one specimen in order to eliminate traces of moisture and impurities before conducting the test? For the drying of oil he found that hot air and sodium answered very well. In one case a transformer oil treated with sodium increased in strength from 107 to 122 kv. per cm.

Mr. J. E. Southcombe, speaking as a chemist with some experience of oil investigation, said that an examination of many samples of transformer and switch oils had not revealed the universal presence of alkali which the authors appeared to have observed. It was an extremely rare thing to find alkali in oils of this type, and if an oil submitted to him for adjudication contained any traces of this substance, he would reject it at once. The authors stated that they found oils containing as much as 57 per cent. of moisture, but it would appear that they had estimated this by drying at 100° C., and noting the loss. This would not give any measure of moisture, since the losses from volatilisation of the oil would always be an unknown quantity, and would totally vitiate the figures. He had conducted a long series of experiments on this matter from several points of view. If an oil contained water at all it was present in fine globules distributed throughout the mass. If the globules were big, the water would quickly settle out of the oil; while if they were very fine indeed they might be retained for long periods, since the mixture would partake of the properties of an emulsion. If the globules were very minute there would have to be an immense number of them present to have anything like 57 per cent. of water in the oil; consequently, the water surfaces would be great, causing considerable thickening, and the oil would be very turbid. It was inconceivable that any self-respecting oil manufacturer would submit such an emulsion for transformers. What was a burning question was the influence of very minute traces of moisture on the insulating properties. An oil might be quite bright and yet contain absorbed moisture; but such moisture was present only to the extent of about 0·1 per cent. or less. The quantitative estimation of such minute traces chemically was almost impossible, but he could say that the dielectric strength was a very delicate test. In his opinion, variations in dielectric strength could be correlated very largely with these exceedingly minute traces of moisture, which had a far greater influence on the electrical properties than any so-called chemical impurity in well-refined oil of standard quality. There was very little evidence to show that disruptive discharge proceeded more readily in the presence of resins, &c.; in fact, resin oils (containing almost wholly resin) were admirable insulators. A study of the figures given in the authors' paper showed that what they called resinoid content did not explain the variations in dielectric strength. The problem of how to get rid of moisture resolved itself very much into a commercial question. The oil man could supply a perfectly anhydrous fluid, but it could not be done if the electrician was going to ask for an oil at a price which would make it impossible to devote much attention to these minute but important details. Considerable success had attended the drying of oil by electrical resistances immersed in the oil, but it would appear to him a better investment to pay the experienced oil manufacturer his price, and demand from him an anhydrous oil. Although the question of chemical impurities did not appear so important as moisture in lowering the dielectric strength, yet it was absolutely imperative that an oil should be of the highest possible purity, since the influence of acids, and more particularly alkalis, on the windings was disastrous; while, at the same time, any tendency for the oil to resinify or oxidise on heating would materially affect its heat-disseminating powers. In addition to the points they drew attention to, no specification would be complete which did not demand tests as to the durability of the oil on successive heating and cooling. On the electrical tests he could not speak with authority, but some experiments made by Mr. Lustgarten at the Manchester School of Technology, and the conclusions of Russell, did not confirm the authors' results at such short distances. Further, the carbon produced by the passage of the arc required some considerable time to settle, and a sufficient interval must elapse before making a second puncture. The carbon produced was disseminated throughout the oil in a kind of semi-colloidal suspension of charged particles, which settled at varying rates in different oils.

The Authors, in a communicated reply, said that the purpose of putting down along with the observed physical behaviour of the oils examined, the results of their chemical examination also, was not to imply that the physical properties found were due to chemical impurities. The slight variations in the reaction of oils which were observed after testing for dielectric strength, might be due to several causes. They could not see anything unreasonable in asking the oil suppliers to work to a standard of specific resistance. It was of the utmost importance for the refiner to supply absolutely dry oil, but it was of no use his doing so unless the necessary care was taken to keep it dry. When the user had to dry his own oil, they would suggest warming it up in a vacuum oven to a moderate temperature. A sample of ordinary illuminating paraffin oil, bought at a very

cheap rate, gave a curve of dielectric strength at least twice as good as the best transformer oil, and, needless to say, both its viscosity and flash point were far lower than those of any transformer oil. It seemed to be generally taken for granted that the alkali in oil invariably existed as hydroxide. This was very far from being the case; and consequently when phenol-phthalein was used as an indicator, considerable traces of alkali escaped detection. The exact measure of the "resinoid" matter was not determined. In most cases it appeared to be tolerably pure resin; but in several instances examination revealed admixture of other substances. Out of considerably more than 100 samples, examined during the last 18 months or so, at least 80 per cent. had been found to contain alkali, sometimes in slight, sometimes in very distinct traces; but had phenol-phthalein been used as an indicator no doubt practically the whole of these would have been returned as neutral. Comparative tests had demonstrated that cochineal and methyl orange were more than 10 times as sensitive to alkaline carbonate than was phenol-phthalein. All the samples were obtained from well-known makers of transformer oil, who all supplied large quantities of such oil. They could not, therefore, be considered to be abnormal samples, as Mr. Southcombe suggested. When Russell said that determinations of dielectric strength were not reliable when tests were made over short distances, he was discussing the experiments of Hobbs, who tested over microscopic distances down to 3×10^{-7} cm., and he suggested that for accurate work at least $\frac{1}{2}$ cm. should be tested over. The distances the authors tested over ranged from about $\frac{1}{2}$ mm. up to over 1 cm., and their results were in accordance with Russell's statement, in that the more consistent readings were generally obtained with the higher voltages than with the low ones. Mr. Southcombe's tests were apparently mostly made with balls as the electrodes, and in his case air bubbles would be more likely to give trouble than in their case where the upper electrode was always a needle. They were forced to suppose that the thickening of oil, in some cases at least, was due to polymerisation of some of the hydro-carbon, of which the oil consisted, or even to chemical change, brought about by repeated heatings and coolings. This was a question for chemists rather than electrical engineers to investigate. For electrical work, nothing but hermetically sealed metallic drums should be permitted for containing the oil. A high resistance was only obtained with very pure oils, and might be taken as a measure of their chemical purity. The value in kilovolts, given on the curves of dielectric strength, was expressed in virtual volts ($\sqrt{\text{mean square}}$), so that the maximum volts applied would be about 1·4 times the values given. A given gap would stand, for a very short time, a voltage which would ultimately break it down, were it applied continuously. From this they would conclude that using a higher frequency, higher dielectric strength would be obtained, than by using a lower frequency.

A Telephone Relay.

By S. G. Brown, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *London, May 5th*, 1910.)

Ever since the introduction of the telephone a real need was felt for a telephone relay when it was discovered that the distance over which telephones could be used was comparatively limited. Many inventors have worked on the problem, and it has been declared by eminent telephone engineers to be insoluble.

Sir Oliver Lodge, in a paper read in December, 1898, before this Society, described a relay consisting of reeds arranged to resonate to particular musical notes; an instrument of this character, however, is not effective in intensifying speech. An articulate relay must possess no resonating properties.

Relays which consist in combining the telephone receiver and the granular carbon transmitter are only partially successful. The telephone relay, to be successful, has to magnify in a continuous manner varying currents that are too feeble to properly affect a Bell telephone receiver, say of the order of 10^{-8} ampere.

The author's telephone relay is based upon the researches of J. J. Thomson, Earhart, Kinsley and others, with regard to the flow of electrons across a microscopic air-gap between two conducting surfaces at different potentials. If the metallic circuit of a dry cell be interrupted by a minute space of the order of 5×10^{-7} cm., the metal at the point of interruption being platinum, the current will continue to flow round the circuit and across the opening, and any slight alteration in the length of the space will vary its resistance and greatly affect the value of the current that flows round the circuit. This conduction space is therefore exactly what is wanted for the current-varying device of a telephone relay, where microscopic mechanical movements are to be transformed into large current changes. The dimensions of the conduction space are so small that it is difficult to ensure and maintain it by direct mechanical means. The current that flows across the space was therefore made to do its own adjustment.

Fig. 1 is a side view of the instrument with the brass cover removed. N is a permanent magnet, continued by soft iron poles right up to but not touching the Invar steel reed P. Round the soft iron pole extensions are wound the two sets of coil windings H and K. The telephone currents to be magnified circulate round the winding H and thus by varying the magnetism set the reed P in vibration. M O are the top and bottom metal contact-pieces, which are opened to an infinitesimal degree to form a microphone by the fine adjusting screw W and by the action of the local current passing through the contact and round the winding K. It is by the action of the local current operating through this winding that the conduction space is formed and afterwards maintained. The regulating winding K must not act when traversed by the rapidly varying telephonic currents; this is brought about by surrounding the iron under the coil by a closed circuited copper sheathing. Eddy currents set up in this sheathing by mutual induction destroy the self-induction of the coil.

Fig. 2 is an enlarged view of the reed P and the contact-pieces M O. In the present instrument the contact is made between

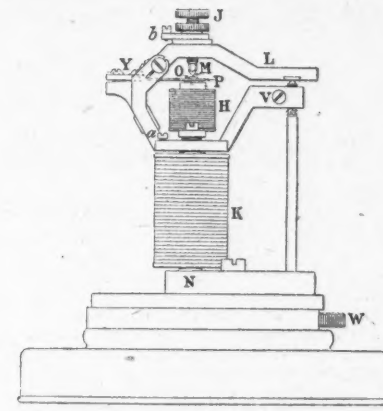


Fig. 1.

metal pieces of hard osmium iridium alloy. The top contact is pointed, the lower one is flat and is soldered to the reed, both are polished and work under a small drop of thin oil.

In earlier instruments the lower contact O was carried by a thin iron disk, the relay was then very susceptible to outside noises. For this reason a reed is now used; it exposes such a small surface to the air that it is practically unaffected by extraneous sound.

Fig. 3 shows the connections of the relay. C is a dry cell (this is the normal voltage, which is as high as it is desirable to employ), K the low resistance regulating winding, T the receiving telephone

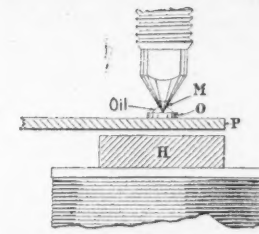


Fig. 2.

or telephone head-piece of approximately 40 ohms resistance, D i an amperemeter or current indicator; when the microphone contact is opened so as to cut down the local current to half its maximum value, the relay is usually at its best adjustment. The telephone currents to be magnified enter by the terminals marked A and circulate through the winding H.

The relay will magnify the very feeblest telephone currents. Speech or signals that are too faint to be heard in the ordinary Bell receiver may be heard clearly through the relay. If a watch

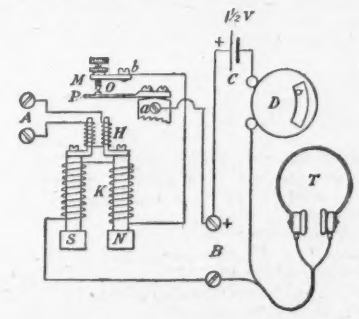


Fig. 3.

be held against the ear-piece of a Bell telephone the induced currents produced when passed through the instrument will reproduce the ticking in the receiver attached; this is a severe test.

This property of magnifying feeble telephone currents has made it particularly useful in wireless telegraphy. On replacing the telephone by the relay the increased sensitiveness thus obtained doubles the distance over which it is possible to receive signals. Its utility in this direction has been tested among others by the Admiralty and the Post Office. In a wireless receiving station, messages, the very existence of which was not even suspected, owing to their extreme feebleness, when listened for under former

conditions, with the relay in circuit were easily read. At the invitation of Mr. Marconi, I took two instruments to the Haven Hotel, Poole. In one of the tests (Clifden, in Ireland, sending with the Marconi musical spark) the signals were heard in the telephone, directly connected, as a faint but clear and pleasing series of musical notes. But with two relays joined to the system and working in series, the notes were rendered so loudly as to be heard clearly by everyone in the room, and an operator listening at

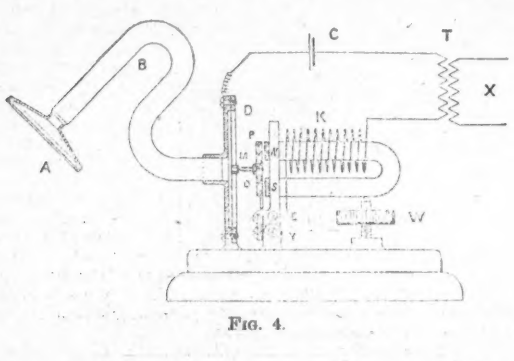


Fig. 4.

a distance of several yards from the instrument could have deciphered the message. The relay is not easily affected by extraneous noises and vibration. It can thus be carried on board ship and worked in all weathers.

As regards its utility on ordinary telephone lines, speech may be magnified many times in loudness without perceptible loss in the articulation, and it will work with large currents to a point at which the Bell receiver in its local circuit is responding with uncomfortable loudness. In experimenting over a 20-lb. standard cable and speaking only one way, it has been proved that, when the relay is applied, 30 miles may be added to any length through which it is possible now to speak direct. For instance, supposing the length of the core for direct speaking be 20 miles, this may be increased to 50 miles for the same loudness and approximate clearness when the relay is in circuit, either as a single repeater at the end of the first 20 miles, or as a receiver at the end of the 50 miles.

These tests prove that the telephone currents must be increased in strength to the extent of something like 20 times. If still greater magnifications are required than can be obtained with one relay, the simplest method would seem to be to employ two relays working in tandem. Their combined power would then be 400 times. In the majority of cases it is not necessary to add to the natural electrical damping of the reed, but if a

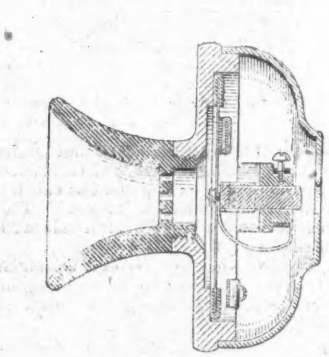


Fig. 5

piece of soft rubber be made to touch it, the voice can be transmitted with greater clearness even than if the conversation were taking place ordinarily in a room. This may be due to the complete absence of echoes.

By means of the local regulating winding (see fig. 2), the metal contact M O is transformed into the most exquisitely delicate microphone, more sensitive, there is every reason to believe, than could be formed by light pressure between carbons. Such a microphone has rendered possible the construction of an electric stethoscope, an instrument by the use of which the sound of the heart or other internal organs may be greatly magnified. This, I have been informed, may render it possible to detect in the earlier stages, heart disease, aneurism, and gall stones.

Fig. 4 is a diagrammatic illustration of the stethoscope. A is the front part and consists of a shallow brass cell faced by a thin ebonite diaphragm. A is placed upon the part of the body to be examined, say, the heart; the beating of the heart is communicated to the ebonite diaphragm, then to the air inside the tube B, and thus the metal diaphragm D is set in vibration. M O, as before, are the osmium iridium contact pieces. M is mounted on the diaphragm, and O on the steel reed P. The magnet N S and the reed are carried by a brass frame E, which is pivoted or hinged at the lower support Y. The conduction space is formed between the contacts M O by turning the fine adjusting screw W, and by the automatic action of the local current from the cell C flowing through the winding X and round the magnet. T is a special telephone transformer of equal windings of, say, 20 ohms resistance in the primary and in the secondary.

The electric stethoscope in its present form causes the sound of the heart to be three times as loud as in the ordinary stethoscope.

Fig. 6.—Telephone Relay.

This is scarcely sufficient for practical purposes. But if a telephone relay, such as I have previously described, be attached to the wires X of the transformer, the two instruments combined raise the intensity of the sound some 20 times and more, and this is ample for all ordinary purposes. The sound to be examined is picked up by the end of the tube A, and is heard in the telephones of a headpiece attached to the relay.

The complete instrument, stethoscope and relay was tested at the London Hospital upon a number of diseased heart cases. When the instrument was applied directly to the heart the sound of the beats given out in the telephones was uncomfortably loud, and easily heard by the patient and all those that stood round, even if the telephones were in position on the head of the operator. The stethoscope, as used, increased the heartbeats to the almost complete exclusion of the shriller or breathing sounds. This has been brought about by mechanically tuning the disk D and the reed P of the telephone relay to the corresponding low note, and by a proper proportioning of the volume of air enclosed by the tube B. On other occasions, during private experiments, the instrument has been tuned so that only the breathing sounds were audible; the passage of air through the lungs was heard as the roar of the wind

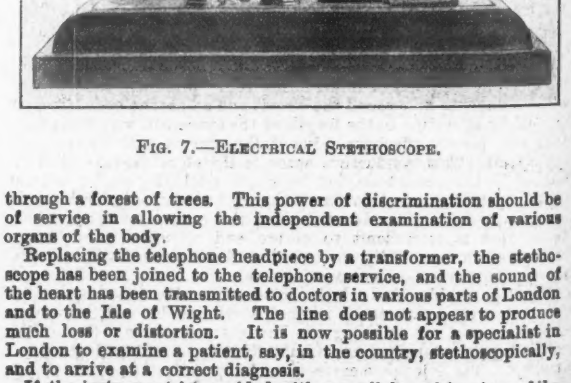


Fig. 7.—Electrical Stethoscope.

through a forest of trees. This power of discrimination should be of service in allowing the independent examination of various organs of the body.

Replacing the telephone headpiece by a transformer, the stethoscope has been joined to the telephone service, and the sound of the heart has been transmitted to doctors in various parts of London and to the Isle of Wight. The line does not appear to produce much loss or distortion. It is now possible for a specialist in London to examine a patient, say, in the country, stethoscopically, and to arrive at a correct diagnosis.

If the instrument is provided with a small funnel in place of the tube B, it will pick up and magnify the slightest sound, and ordinary speaking may be increased to a deafening shout in the telephone. Such an instrument, when properly constructed for the purpose, may be of use to those who are afflicted with deafness.

During some experiments with the telephone relay, attempts were made to dispense with the regulating winding and form the microphone by the mere pressure of the electrodes one against the other as with carbon. With gold, platinum, palladium and rhodium it was not possible to do so. On the contrary, a microphone could be formed by light pressure between the following:—Iridium, ruthenium, osmium, and osmium-iridium alloy. They are arranged advancing in the order of their effectiveness, which likewise is the order of their hardness. With iridium the action was only just shown, while osmium-iridium alloy makes a microphone that can carry large currents, stand high temperatures, and is exceedingly sensitive to small changes of pressure. This alloy is by far the best of the whole series, as it is the hardest, and although expensive, can be readily purchased as natural grains or granules, sifted to any desired uniform size.

Several "solid-back" transmitters have been taken and altered in various ways to make use of the new metal. In one case the ordinary carbon electrodes were entirely removed and replaced by sheet iridium-faced ones $\frac{3}{16}$ in. in diameter; these electrodes were separated by a distance of $\frac{1}{20}$ in., and the space between was nearly filled by 3 grains weight of very fine granules of osmium-iridium kept in place by a rubber tube. This new transmitter would take permanently a current of $\frac{3}{4}$ ampere from a 2-volt accumulator. It was connected to the telephone service through a large transformer, which had a low-resistance primary of only $\frac{1}{10}$ of an ohm. The ordinary carbon transmitter, supplied in the usual way from the central battery, was kept in position in series for the purpose of comparison. The results of several trials were as follows: Speaking on both occasions with equal force, first, directly into the mouthpiece of the carbon transmitter; secondly, 12 in. away from the mouthpiece of the metal transmitter, the same volume was given in the receiving telephone. When the new transmitter was spoken into at a distance of 3 in. the sound was two or three times louder than is at present normal, and when spoken into directly, the sound at the far end was uncomfortably loud and the voice could be heard with ease 3 yards away from the receiver. In all cases the articulation was clearer and crisper with the metal than with the carbon transmitter.

As the iridium faces of the electrodes became superficially oxidised, the iridium has been replaced by gold, which so far has proved satisfactory. Another improvement was to cone inwards the faces of the gold electrodes; this is to prevent the granules from unpacking, as they had previously a tendency to do when worked between plane faces.

An osmium-iridium granular transmitter has been constructed embodying all these later improvements (see fig. 5); the electrodes have a diameter of $\frac{1}{4}$ in., and it will work permanently with 1 ampere at 2 volts. When joined to the telephone circuit and spoken directly into, the distant receiver will respond with overpowering loudness. It has been tried over 60 miles of 20 lb. standard artificial cable, and will work over this length with clearness and reasonable loudness, showing that this was by no means the limit. In all these trials a local battery was used. The metal transmitter has a low resistance; this would have to be raised by a suitable design to make it really successful. The upper harmonics of the voice are more faithfully transmitted by the metal granules than by the carbon—this accounts for the superiority in the articulation. A much smaller quantity of the metal powder or granules is required as compared with carbon, and its sensitiveness in resistance to small changes of pressure is much greater; the new material is therefore peculiarly adaptable for the purposes of a relay for use on telephone lines where moderate magnification only is required. Such a relay has been constructed using osmium-iridium powder as the resistance varying medium; it is simple in design, requires no adjustment, and so far gives a moderate magnification with good articulation.

A telephone relay, if placed simply in the middle of a long telephone line, can magnify the currents only in one direction—such a device is called a single repeater. The relay for practical use has therefore to be associated with balancing coils and placed in the line so that it may work in either or both directions—such a combination is termed a two-way repeater. Theoretically it would seem that the two-way repeater can be only one-quarter the efficiency of the single repeater. Although the one-way relay is now solved it will be seen that there is still much to be done before the two-way repeater is practicable.

Mr. S. Evershed (in the chair), in opening the discussion, welcomed the author's improvements, especially in the transmitter, but thought it absolutely necessary to produce a receiver suitable for loud speech.

Mr. J. E. Taylor said it was some three or four months since he tried the author's telephone relay in connection with wireless transmission work. It had appeared a little unstable then, but closer attention showed that it was capable of maintaining its adjustment and keeping its magnifying properties. It could pick up signals which would ordinarily be inaudible. As regards the transmitter, he found that 43 to 45 miles of standard cable and ordinary apparatus gave imperfect speaking, but an ample volume of sound, and easily-understood speech was obtained over 60 miles with the author's transmitter. He could not as yet say what the apparatus would do under practical conditions.

Mr. B. Davies referred to the work done by Sir Oliver Lodge, 10 years previously, in connection with carbon point relays; it was intended to produce a monotone relay, and while the speech was good there was a loss in articulation which was magnified in series working. He thought the loss was due to the mechanical deterioration of the carbons, but the author was using the hardest of points. He asked if the author had tried his relay on a really long line however successful a relay was, it did not get over the loss and distortion in the line itself.

Dr. Voisey, speaking from a medical point of view on the author's stethoscope, which he had used, said that clinically it might render it possible to detect sounds in the human body which were only suspected now, and to obtain much earlier indications of disease than were at present obtainable. Loudness was, however, not everything; it might be necessary to choke down the volume of sound, and to tune and make the instrument selective.

Mr. J. E. Kingsbury, referring to earlier inventions relating to relays, said the first patent for such a device dated back to 1881; the Shreed relay or repeater, patented in 1905, was a practical device, and had been used to some extent with fairly satisfactory results. He hoped the author's device would be further developed, as a relay should work both ways to be of practical use. It appeared to him that there was a similarity between the author's relay and the Berliner microphone; and he was also under the impression that substitutes for carbon had been tried in making transmitters.

Mr. B. Cohen said he had experimented with the relay, but had not obtained quite such good results as the author. The Shreed repeater was used in the States and in the centre of a 12-mile line. The improvement by using a repeater in both lines was equal to 6 miles of cable. He found that the transmitter gave an improvement of 10 standard miles, and it was a promising development, but he believed that the present transmitter would not work on a common-battery system.

Dr. Eccles said that relays for wireless work, if not selective, took up many other sounds in addition to signals. He (the speaker) had been working at a relay on much the same lines as the author, and with it had been able to magnify the Clifden signals, received in London, two or three times. But the defect was that the instrument would go on singing after the signals ceased. He thought that the tuning must be very difficult.

Mr. W. M. Mordey read an extract from a telephone paper read before the Institution in 1883, showing the possibilities of metal microphones as against carbon; the earliest experiments in microphones were made with metal.

Messrs. A. C. Booth and D. H. Kennedy mentioned having tried the author's relay and obtained with it as loud, but not such clear, speaking over 68 miles, as over 34 miles without a relay. Good speech was also obtained over 108 miles with the relay, while speech was inaudible without it. The possibility of adjustment, milliampere by milliampere was very striking, but this took time, and might be a disadvantage in practical use.

Mr. S. Evershed said it should be recognised that the so-called relay was a magnifier and repeater; it could not supply what was not there.

The author's reply will appear in the *Proceedings*.

Automatic Telephone Exchanges and the Business World.—The question of the advantages, or otherwise, of the conversion of the existing telephone system to the automatic system has been recently exercising the minds of the inhabitants of Munich. An experimental installation of the new type has been introduced into one district, and the possibility of its extension to the whole town is not viewed with unmixed approval. Those who place most importance on the avoidance of wrong interconnections are inclined to favour the new arrangement, whilst those who consider that a quick and easy method of getting into communication is of the first importance, point out that even with the automatic device the caller may still make wrong connections, whilst he will certainly have to give more attention and care to the making of a call than if he has simply to give a number verbally to the operator. The whole matter was discussed recently at a meeting of the Munich Chamber of Commerce, when Herr Joseph Pschorr dealt with the pros and cons in detail. He pointed out that the existing system, with the exception of occasional lapses due to unskilled operators, worked satisfactorily, and was, in fact, one of the best in the kingdom. With the new arrangement the cost would be increased, whilst it would have the effect of transferring the operators from the employment of the State to that of the private individual or firm, either directly or indirectly; for either separate skilled operators must be employed, or else the valuable time of the heads of departments and other officials of the firms must be wasted to a greater or less extent in undertaking the duties previously carried out by the operator at the exchange. If, as is likely, the time to make a call is increased four or five-fold, it will mean, in the case of the larger firms, a considerable increase in the number of instruments needed to cope with the business. Altogether the actual increase in cost is difficult to estimate, and before any further extension of the automatic system is made every opportunity should be given to both large and small firms to test the matter for themselves. The fact that the automatic system has met with considerable success in America is no criterion, for, in America, private competitive telephone companies are the rule, and the inhabitants of a town have the choice as to which form of telephone installation to adopt, whilst in Germany, under a State monopoly, no such choice exists. The Chamber of Commerce has decided to send a deputation on this subject to the Minister of Commerce.—*E.T.Z.*

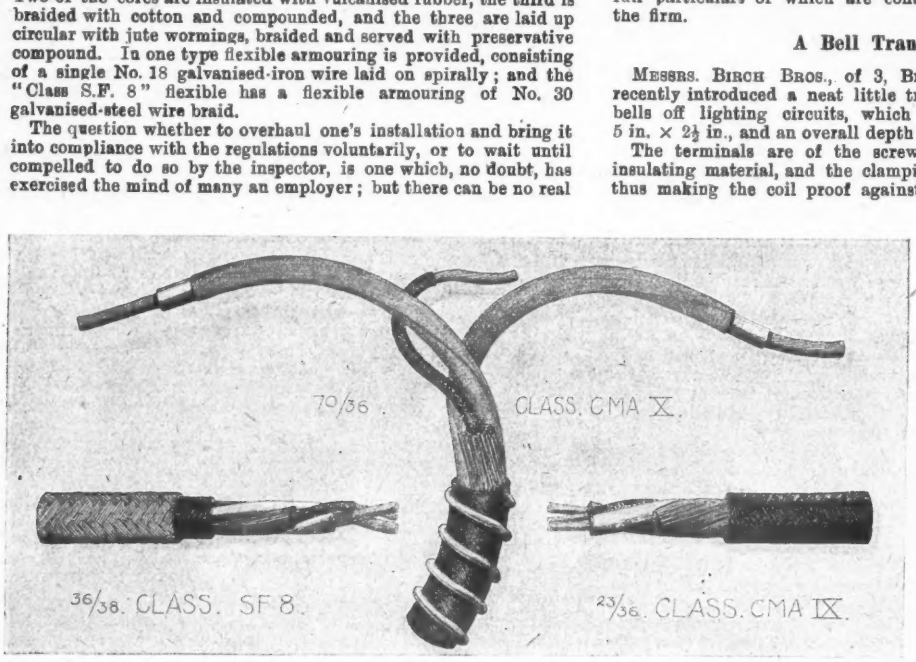
Colne Electricity Supply.—At the meeting of the T.C., on the 4th inst., it was reported that, instead of having no profits, as estimated at the beginning of the year, the accounts showed a profit of £400.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

"Home Office" Twin Flexible.

In order to comply with the Home Office regulations, in certain circumstances portable lamps, &c., must be provided with a three-core flexible, one core being used for the purpose of earthing the metal-work of the fittings. To comply with this requirement, Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C., have introduced flexibles of the types here illustrated. Two of the cores are insulated with vulcanised rubber, the third is braided with cotton and compounded, and the three are laid up circular with jute wormings, braided and served with preservative compound. In one type flexible armouring is provided, consisting of a single No. 18 galvanised-iron wire laid on spirally; and the "Class S.F. 8" flexible has a flexible armouring of No. 30 galvanised-steel wire braid.

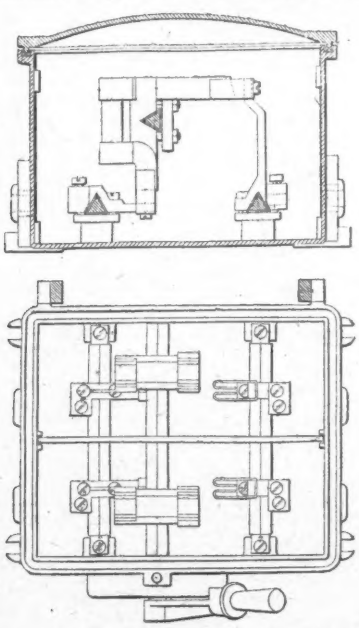
The question whether to overhaul one's installation and bring it into compliance with the regulations voluntarily, or to wait until compelled to do so by the inspector, is one which, no doubt, has exercised the mind of many an employer; but there can be no real question as to the rights of the matter. Anyone who neglects to carry out the rules makes himself personally morally responsible for any casualty that may result, and, in view of that consideration, there ought to be no hesitation in proceeding with the work.



Henley's "Home Office" Twin Flexible.

The Cantie Switch.

We have received from the Cantie Switch Manufacturing Co., of Nottingham, one of their latest-pattern rotary switch-fuses, which is particularly adapted for industrial purposes, and of which views are given here, the switch being shown in the 'on' position in elevation, and in the "off" position in plan.



The Cantie Switch.

The switch is of the double-pole ironclad gas-tight variety, with the terminals mounted on mica-insulated bars, supported clear of the case. The rotary switch contacts are mounted on a similar bar, which continues through the case and a spring box, attached outside, to the handle. The switch has a remarkably quick make-and-break, and the moving blades—as they break contact at both sets of terminals—are isolated in the "off" position, when fuse replacements would be carried out. We may add that the switch handle locks the lid, except in the "off" position.

The switch-fuses are rated at up to 30 amperes 250 volts, and up to 25 amperes 500 volts. One of them was recently subjected to extended tests for flaring, fusing, overload and insulation resistance at the National Physical Laboratory, with very satisfactory results, full particulars of which are contained in a leaflet issued by the firm.

A Bell Transformer.

Messrs. Birch Bros., of 3, Brunswick Place, Leeds, have recently introduced a neat little transformer for ringing electric bells off lighting circuits, which has a base measurement of 5 in. × 2½ in., and an overall depth of 2 in.

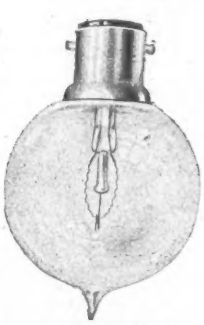
The terminals are of the screw-down pattern, embedded in insulating material, and the clamping screws can be iron-sealed, thus making the coil proof against accidental contact with live metal. The transformer cores are of the best quality transformer iron, with the result that the power loss on open secondary circuit is under ¼ watt. Should a short circuit develop on the bell wires, no harm would result, as the transformer may be run on dead short circuit for an indefinite period without burning out, the watts taken under these conditions being about 12.

The firm also supply a coil with three bell terminals, thus furnishing three different voltages from one transformer—a matter of convenience in large installations where some circuits include indicators and others do not. We may add that Messrs. Birch specialise in high-efficiency auto-transformers for all purposes, ranging from 300 watts upward.

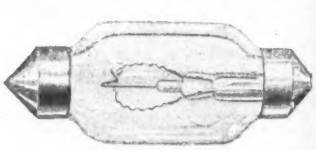
Bell Transformer.

"Onewatt" Metal-Filament Battery Lamps.

As we recently mentioned, Messrs. Siemens Bros. Dynamo Works, Ltd., Tyssen Street, Dalston, are introducing a series of battery (low-voltage) lamps with drawn tungsten wire filaments, and we have now received particulars of the various sizes and shapes of these. The lamps are supplied in the "pea" type from 1·3 to 5·5 volts, giving from ¼ to 1½ c.p.; in the flame-candle shape from 2 to 5·5 volts; in the pipless round shape from 1·3 to 4 volts; and in spherical bulbs from 2 to 16 volts. They burn at about 1 watt per candle. "Onewatt" battery lamps for motor car and



"Spherical."



"Festoon."

"Pea Lamp."

yacht lighting are made in tubular, festoon and mushroom shapes, for various pressures up to 8 volts. A compact but comprehensive list is about to be issued, covering all these varieties in a single sheet. We illustrate a few of the new patterns on page 806.

We now have all sorts of "Onewatt" low-voltage lamps at our command, while a 100-C.P. 200-volt "Onewatt" lamp is at this moment burning over our desk. Presumably the makers are holding back lamps of the intermediate sizes and voltages until they can accumulate an adequate stock, and no doubt in a few weeks we shall be able to record the advent of the 25 and 50-candle sizes with drawn tungsten filaments.

Coal Meter.

In the *Electrical World* of April 14th, a coal meter of the inferential type is described, which is designed to measure the delivery of coal or other granular material. The device consists of a spiral vane, inserted in the centre of the delivery chute, and positively geared to a registering mechanism recording the downward movement of the column of material. The rotation of the vane has been found to vary directly as the quantity of material passing it. The meter is of simple and rugged design. All parts coming in contact with the material measured are made of bronze to withstand corrosive or rusting action, and the gears and bearings run in a bath of oil. The counter may be set to read in pounds, tons, cubic feet or bushels, as desired. Practical tests seem to show that this meter may be relied on for accurate and trustworthy readings. It is manufactured by O. D. HARVARD Co., Scranton, Pa.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEW FRENCH TARIFF.

THE following are the rates of duty leviable on electrical and similar goods under the new French tariff, which came into force on April 1st of this year:—

	Francs per 100 kg.
Pipes and moulded articles of cement and concrete ...	1
" " " reinforced cement ...	1·50
Graphite or plumbago	free
Bitumen	free
Bitumen and asphalte: rock and cement	free
tiles, paving blocks or slabs ...	1
Wire of iron or steel, whether tinned, coated with copper or zinc, or galvanised, or not, whitened or not:	
Less than 70 kg. breaking strain per sq. mm. of section, and of a diameter of:—	
More than 2 mm.	7
" 1 " up to 2 mm.	10
" $\frac{5}{10}$ " " 1 "	12
$\frac{5}{10}$ mm. or less	20
From 70 kg. to 175 kg. breaking strain per sq. mm. of section, and of a diameter of:	
More than 2 mm.	10
" 1 " up to 2 mm.	13
" $\frac{5}{10}$ " " 1 "	15
$\frac{5}{10}$ mm. or less	30
More than 175 kg. breaking strain per sq. mm. of section, and of a diameter of:	
More than 2 mm.	17
" 1 " up to 2 mm.	25
" $\frac{5}{10}$ " " 1 "	37·50
$\frac{5}{10}$ mm. or less	50
Rails of iron or ordinary steel	6
Rails of special steel, *i.e.*, into the composition of which enters more than 9 per cent. of manganese	10
Wheels, tires and wheel centres (*centres de roues*) of iron or steel:	
For railway and tramway cars and carriages:	
Rough	8
Worked	10
For loc motives:	
Rough	8
Worked	12
Straight axles for railways and tramways, axles not specially mentioned, of iron or steel:	
Rough	8
Worked	13
Crank-axles for locomotives, of iron or steel:	
Rough	12
Worked	20
Copper, in wire, polished or not, other than gilt, silvered or nickeled, of a diameter of:	
$\frac{1}{10}$ mm. or more	12
Less than $\frac{1}{10}$ mm.	15
Copper, rolled or hammered, in plates of a thickness of	
$\frac{1}{10}$ mm. or more	12
Less than $\frac{5}{10}$ mm.	15
Articles for electricity, of porcelain, faience, stoneware, white or coloured, without parts of metal or other materials:	
Insulators, bell-shaped, of 90 mm. diameter or less	10
" " other	15
Other: weighing 100 grammes or more	20
" less than 100 and more than 10 grammes	35
" 10 grammes or less	50
Articles for electricity, of glass, without fittings of metal, are dutiable as articles for electricity of porcelain, &c., at the above rates.	
Incandescent electric lamps:	
With carbon filaments, with mountings	350
" metal " " "	500
Without mountings	700
Electrometers, and in general all meters and measuring apparatus fitted with clock movements	75
Steam and other engines:	
Steam engines, stationary and marine, without boilers, steam pumps, stationary engines for compressing air and various gases, motors worked by gas, petroleum, alcohol, hot air, compressed air and any other gaseous or explosive mixture, and all other motors not mentioned,* with pistons, weighing:	
More than 100,000 kg.	12
50,000 to 100,000 kg.	14
1,000 to 50,000 kg.	16
250 to 1,000 kg.	18
100 to 250 kg.	26
50 to 100 kg.	36
Less than 50 kg.	40

* For these machines the importer must furnish a declaration stating the designation, weight and nature of the component parts, as well as a plan or drawing of the machine.

The same, without pistons (the above duties, according to class, increased by 50 per cent)

(*To be continued.*)

EXPIRING PATENTS.

(*Concluded from page 764.*)

23,742. October 27th, 1896. "Electric switches and cut-outs." R. BELFIELD, London, S.W. (A. J. Wurts, Pittsburg Pa. U.S.A.) Switches or cut-outs are arranged so that (1) the arm shall not be moved to break the circuit should the apparatus be jolted; (2) magnetic cut-outs shall not operate for a momentary increase of current; (3) in cut-outs for multiphase currents, an excess of current in one line shall cause all the circuits to be broken; and (4) sparking shall take place between auxiliary contacts so that the main contacts shall not be damaged.

20,505. September 16th, 1896. "Secondary batteries." H. IMRAY, London. (R. J. W. Grindle, Dieppe, France.) Relates to electrodes of the kind described in specification No. 8,728, A.D. 1895, which consist each of a plate with holes therein filled with rolled-up strips of lead, having transverse ridges and furrows on one side. In order to improve the conductivity of these plates, there is added a central longitudinal ridge connecting all the transverse ridges.

21,288. September 24th, 1896. "Electric lamps, &c." C. H. STEARN and C. F. TOPHAM, both of Westminster. Incandescent lamps: vacuum tubes.—Lamps for producing light or Röntgen rays, by electric discharges in exhausted vessels falling on suitable anticathodes, are provided with means for automatically keeping the vacuum in any required condition. For producing light, the anticathodes are made of refractory earths, such as thorium oxide, either in compressed disks or, preferably, several layers of fabric.

21,262. September 25th, 1896. "Centrifugal machines." R. WILLIAMSON, Motherwell. Driving by electromotors.—The spindle of a suspended centrifugal drying, &c., machine carries an armature. The field magnets are mounted in a casing carried by the stationary spindle, and thus receive the same oscillatory motion as the rotating shaft and armature; the casing is prevented from rotating. A tray is provided to throw off oil escaping from the bearing and prevent its access to the motor.

21,748. September 29th, 1896. "Punching telegraphic strips, &c." W. L. WISE, London. (C. L. Buckingham, New York, U.S.A.) Punching and perforating machines.—Relates to apparatus for perforating a strip of paper, &c., for use in a telegraphic transmitter, with groups of perforations, each group representing a letter of the alphabet or other character. The apparatus may also be used for punching strips for musical instruments, jacquard looms, &c. The strip has a central line of perforations, which serve to facilitate the feeding and delivery of the strip to or from the punches for punching the marginal perforations. The punching apparatus is combined with an ordinary Remington typewriter, so that a typewritten copy of the message punched on the paper strip is simultaneously obtained.

26,249. November 2nd, 1896. "Electric heating apparatus." H. J. DOWSING, London. An electric heating device, such as a glow lamp, is provided with a reflector of projecting, conical, pyramidal, or wedge-shaped form to reflect the heat rays from the lamp globe and prevent overheating the latter. An aperture in the reflector around the lamp admits air for cooling the globe, or the reflector may be perforated with minute holes for the same purpose. A number of lamps may be arranged in a vase with a reflector below and heat absorbing material above, the whole acting as an open stove, or a number of lamps are arranged side by side in a frame and provided with suitable reflectors.

28,612. November 14th, 1896. "Telephone system." A. J. BOULT, London. (Soc. Anonyme de Telephonie Privée, Brussels.) Telephones for houses and other small installations are arranged with all the wires brought to a multiple plug switch at each station, and having one or more common return leads for use when common or separate call batteries are employed.

20,144 December 31st, 1896. "Casting metals." A. F. COTHIAS IVRY, France. Certain metal articles, such as lead customs' seals, secondary battery plates and the anodes of electroplating plant, are rendered porous by evaporating some suitable liquid, such as oil, in the mould during casting. The metal is injected through a nozzle, while the core is covered by a plate of the volatile liquid, supplied in drops from a reservoir on to a perforated film.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

10,032. "Improvements in connecting electric conductors." R. E. Raven. April 25th.

10,041. "Improvements in the manufacture of electric glow lamps." H. Malachowski. (Date applied for under Sec. 91 of the Act, September 3rd, 1909, being date of application in Germany.) April 25th. (Complete.)

10,043. "Improved electric illumination plant for theatres and the like." T. Weil. April 25th. (Complete.)

10,048. "Improvements in electric measuring apparatus and the like." G. W. Harris. April 25th.

10,065. "Improvements in and relating to holders for electric incandescent lamps." C. C. Regnart. April 25th.

10,097. "Improvements in or relating to electric heating apparatus." H. Lofquist. April 25th.

10,162. "Improvements in automatic telephones." F. H. Lee. April 26th. (Complete.)

10,164. "Improvements in electrical terminals." E. W. Clare. April 26th.

10,172. "Improvements in or relating to polyphase electric series motors." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) April 26th. (Complete.)

10,175. "Improvements in secondary batteries." H. C. Woltereck. April 26th

10,192. "Improvements in and relating to electric tramways worked on the conduit system." L. E. Saunders. April 26th.

10,208. "Dynamo electric machines." A. Meynier. (Date applied for under Sec. 91 of the Act, April 26th, 1909, being date of application in Belgium.) April 26th. (Complete.)

10,210. "Improvements relating to apparatus for strengthening weak electrical impulses, particularly applicable for use in wireless telegraphy." W. P. Thompson. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) April 26th. (Complete.)

10,221. "Improvements in carburetter for internal combustion engines." H. A. Kellaway and R. D. Bowman. April 26th.

10,245. "Method of and appliances for stopping, starting and reversing electrically driven winding and other gear." W. J. Hollick. April 27th.

10,252. "Improvements in multiple electric ignition apparatus." R. F. Hall. April 27th.

10,315 "Improvements in or relating to electric switches." Siemens Bros. Dynamo Works, Ltd. (Siemens-Schuckertwerke G.m.b.H., Germany.) April 27th. (Complete.)

10,334. "Coin-operated mechanism for supplying electricity." C. Kretz. April 27th.

10,338. "Improvements in and relating to electric switches." British Thomson-Houston Co., Ltd., and E. B. Wedmore. April 27th.

10,370. "Improved system for controlling electric motors by means of a Leonard connection." E. C. R. Marks. (Felten & Guilleaume Lahmeyerwerke Akt. Ges., Germany.) April 27th. (Complete.)

10,373. "System for electric distance control of railway points and other movable parts." L. Haasted. (Date applied for under Sec. 91 of the Act, April 28th, 1909, being date of application in Norway.) April 27th. (Complete.)

10,423. "Improvements in electric switches." A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. April 28th. (Complete.)

10,454. "Improvements in sparking plugs for igniting combustible mixtures." E. A. Nicholls and H. A. Humphrey. April 28th.

10,474. "Improvements in electric switches." H. Hirsch. April 28th. (Complete.)

10,506. "Improved safety device or cover for pendant or other electric lampholders." R. Eyre and W. Harrison. April 29th.

10,524. "Improvements in and relating to electric car ploughs for making electrical connection with conductors in conduits." Bruce Peebles & Co., Ltd., and E. Klaps. April 29th.

10,530. "Improvements in automatic apparatus for controlling electric circuits." H. Hirst and J. W. Record. April 29th.

10,561. "Improvements in or relating to zinc carbon bag electric elements." W. Weber and A. Schmidt. April 29th.

10,577. "Improvements in or relating to telephone systems." E. A. Graham. April 29th. (Complete.)

10,606. "Improvements in and relating to alternating current dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. H. Clough. April 29th.

10,607. "Improvements in and relating to electric motors." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, April 30th, 1909, being date of application in Germany.) April 29th. (Complete.)

10,631. "Improvements in electro-magnetic massage vibrators." C. Brice. April 30th.

10,647. "Improvements in electrolytic apparatus for plating small articles and goods." A. E. Cook and A. J. Cook. April 30th.

10,654. "Improved form of current limiter for use with fixed rate systems of charging for electrical energy and for other purposes." E. E. Hoadley and H. Tindall. April 30th.

10,676. "Improvements in reinforced concrete telegraph poles and the like." R. Esparza. (Date applied for under Sec. 91 of the Act, February 28th, 1910, being date of application in Spain.) April 30th. (Complete.)

10,692. "Improvements in and relating to alternating current dynamo-electric machines of the commutator type." Allgemeine Elektricitats Ges. (Date applied for under Sec. 91 of the Act, May 1st, 1909, being date of application in Germany.) April 30th. (Complete.)

10,693. "Improvements in and relating to supports for electric conductors." E. B. Koopman and P. Welding Patents, Ltd. April 30th. (Complete.)

10,694. "Improvements in and relating to electric heating machines." E. B. Koopman and Pontelec Welding Patents, Ltd. April 30th. (Complete.)

10,705. "Improvements in electric conduit threaders." G. A. Brown, D. R. Gourlay. April 30th. (Complete.)

10,706. "Electro-mechanical separator." E. G. Godfree. (Date applied for under Sec. 91 of the Act, May 28th, 1909, being date of application in Australia. April 30th. (Complete.)

Lytham.—The U.D.C. has consented to energy being supplied to St. Cuthbert's Church by the Blackpool, St. Anne's and Lytham Tramway Co. for a motor for organ blowing. Application has also been made for consent for the company to supply the church lighting.

The E.L. and Power Co., which has an E.L. Order for the district, has informed the Council that it is hopeful of being able to complete the necessary financial arrangements which will enable it to carry out its obligations.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

Apparatus for Rectifying Alternating Currents. E. Giglio. 17,742. July 30th. (Date applied for under International Convention, April 29th, 1909.)

Process and Apparatus for Wireless Operation of Switches and other Apparatus at a Distance by Sound Waves and other Vibrations. G. M. Karolyi, E. Klupathy and C. Berger. 17,989. August 3rd. (Rights under Sec. 91 of Patents, &c., Act, 1907, not granted.)

Safety Electric Connector Plug. J. F. Conrad and E. S. Conrad. 18,128. August 7th.

Distributor for High-Tension Sparking Apparatus for Multi-Cylinder Internal-Combustion Engines. Firm of Unterberg & Helmle. 19,024. August 18th. (Date applied for under International Convention, August 19th, 1908.)

Electric Switches. J. P. Jakobsen and H. F. Jensen. 25,551. November 5th. (Date applied for under International Convention, August 11th, 1909.)

Rectifiers for High-Tension Alternating Electric Current. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 26,466. November 15th.

Junction and the like Boxes adapted to carry various Fittings, such as Ceiling Roses, Fuses, Switches, and the like in Surface Systems of Electric Wiring for Buildings. Simplex Conduits, Ltd., and L. M. Waterhouse. 7,995. April 3rd.

Electric Clock. F. Schneider. 8,123. April 5th.

Means for the Manufacture of Bushes or Bearings for Shafts, Axles Electric Motors, Dynamos, Self-Propelled Vehicles and the like. W. G. Hanna and R. G. Hanna. 8,382. April 7th. (Cognate application, No. 22,869 of 1909.)

Electric Conductors. R. K. Gray. 8,419. April 7th.

Magneto-Electric Machines. F. Burks. 8,339. April 8th. (Date applied for under Rule 13, March 5th, 1909.)

Manufacture of Rods or Filaments of Refractory Material, applicable for use in Electric Lamps. British Thomson-Houston Co. (General Electric Co.) 8,781. April 13th.

Enclosed Electrical Machines. H. A. Mavor and Mavor & Coulson, Ltd. 9,133. April 17th. (Cognate application, No. 16,174 of 1909.)

Wireless Telegraphy. J. Rymer-Jones. 10,886. May 4th.

Electric Motor Meters. Siemens Schuckertwerke Ges. 11,634. May 17th. (Date applied for under International Convention, June 6th, 1908.)

Electric Motor Meters. Akt.-Ges. Korting's Elektricitäts Werke. 12,878. June 1st. (Date applied for under International Convention, November 9th, 1908.)

Suspending or Supporting of Electric Incandescent Lamps and the like, and the Raising and Lowering of the same. J. Lear. 14,675. June 23rd.

Electrically-Controlled Brakes for Cranes and the like. B. Thomas and E. Thomas. 15,541. July 3rd.

Process for Forming Carburised Metal-Filaments for Electric Lamps in Gases. W. Heinrich. 15,065. July 9th.

Electro-Magnetic Clutches. C. W. Hill. 16,095. July 10th.

Production of Electric Light Between the Electrodes of Arc Lamps. Ges. fur Elektrotechnische Industrie and J. Gyuris. 16,855. July 19th.

Illuminated Electric Signs. L. Miller. 24,190. October 21st.

Incandescent Electric Lamps. H. J. Jaeger. 23,006. November 10th.

Disk Water Meters. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 28,807. December 9th.

1910.

Commutators of Dynamo-Electric Machines. Siemens Schuckertwerke Ges. 1,397. January 18th. (Date applied for under International Convention, February 6th, 1909.)

Method of and Means for Suspending Telephonic Microphones in Combination with a Breastplate W. Tardieu. 1,7.4. January 24th.

Telephone Exchanges. Siemens & Halske Akt.-Ges. 2,608. February 2nd. (Date applied for under International Convention, February 12th, 1909.)

Electro-Magnetic Brakes. Westinghouse Electric Co. 4,171. February 19th. (Date applied for under International Convention, March 3rd, 1909.)

Halley's Comet.—This interesting visitor to our Solar system is, according to the daily Press, hardly visible to the naked eye, and even with the aid of binoculars can only be seen at the, to say the least of it, inconvenient hour of 3 a.m. We are, however, afraid that the daily Press is in this instance sadly behind the times, for just as it was left to George Palitzsch, the Dresden farmer, to prove Halley's prophecy to be correct by first sighting the comet on Christmas night, 1758, on its first return to our system, after Halley made his prophecy, so it has been left in this instance to a well-known inhabitant of Chelmsford to first sight the comet on this, its third visit, since Halley observed it.

One evening last week this gentleman (not Halley) was returning from his club about 11.45 p.m. when he suddenly obtained a splendid view of the comet, the head of which seemed to rest on the neighbouring hill of Galleywood, while the tail seemed to be right overhead. So magnificent was the sight, that he hurried home and roused his wife, who had retired for the night, and together they dressed the children and took them out in the street to obtain a better view; after a short period, however, it disappeared as suddenly as it had come.

Messrs. Crompton & Co., we understand, conducted an all-night test at Chelmsford, one night last week on the neighbouring hill of Galleywood, with their latest type of projector or searchlight, the powerful beam of light being seen for miles around.

Budleigh Salterton.—At the local Council meeting recently a letter was received from a Mr. Purves asking the Council for permission to obtain a prov. order to supply electricity for lighting and other purposes in the district. It was decided to ask Mr. Purves to supply further particulars and also to forward a copy of the prov. order.